SCIENTIFIC AMERICAN

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

Vol. XXVIII.--No. 9.] [NEW SERIES.] NEW YORK, MARCH 1, 1873. [$3 per Annum, IN ADVANCE.

THE ECLIPSE SECTIONAL STEAM BOILER.

The invention herewith illustrated is a steam boiler composed of a number of separate sections, each by itself comprising all the parts of a complete steam generator. Our engraving represents a double form of the device, so constructed as to economize room and yet afford a large heating surface. The upright chamber, A, and < shaped series of tubes, B, compose one section; portions of others similarly constructed, placed beside each other so as to form the rear of the apparatus, are shown at C and D. Any required number of sections may be thus located. The chamber, F, and tubes, G, correspondingly arranged, constitute the first of a series of sections which form the front of the boiler. All the chambers communicate at the tops and bottoms, so as to form continuous mud drums at H and I, and water spaces at K and L, the latter connecting by means of the pipes, M, with the steam drum, N. The sections composing the front portion of the boiler are less in number than those in rear, for the reason that every other one is omitted in order to afford the necessary space for the doors.

Both parts of the apparatus, front and rear, have independent circulations, that in the former commencing in the mud drum, H, passing through the tubes, G, to the water space, K, and thence back; in the latter, the circulation commences from the drum, I, passes through tubes, B, space, L, and return, and, being very rapid, prevents the accumulation of scale or sediment in any portion except the mud drums, which may be easily cleaned. The sections have man holes on both sides, and are held together by short bolts on the inside around these openings. The facing strips are of sufficient thickness to hold the sections apart and to allow the smoke to pass, thus making the entire boiler into heating surface, except the steam drum and bottom of the mud drum. The drums will allow a man to enter and pass through the sections, so that, in any case, should a tube become disabled, it may be replugged without loss in the service of the boiler.

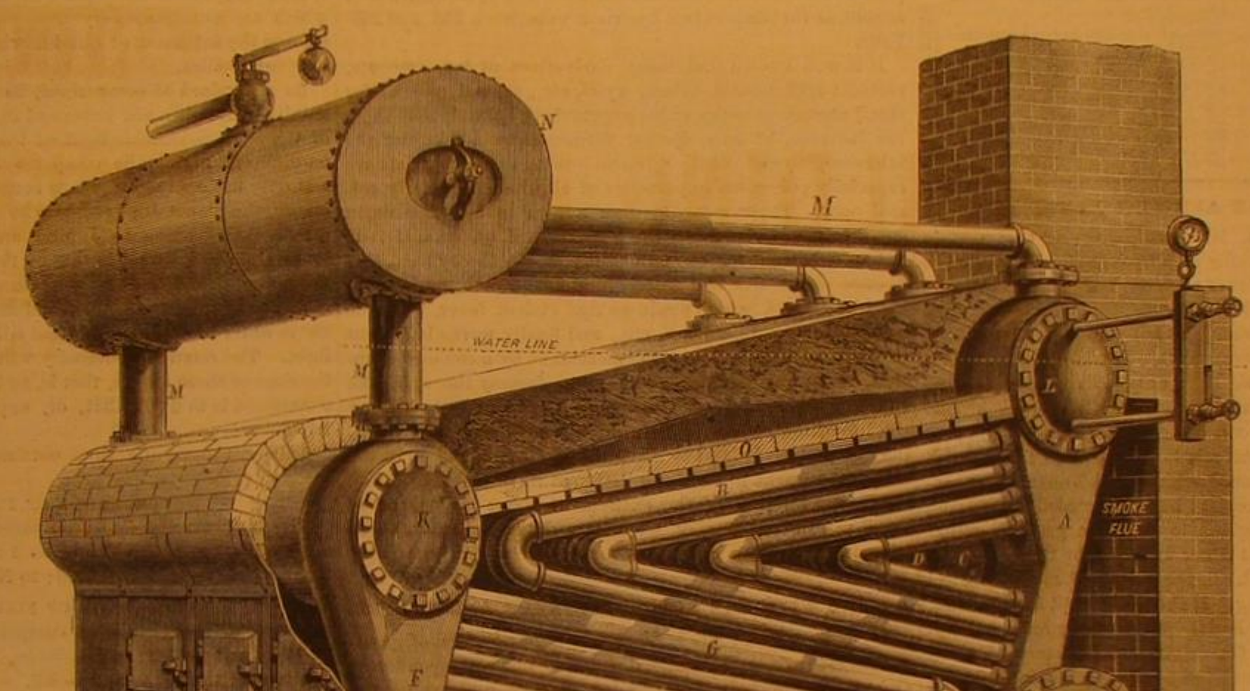
It is claimed that the angular form insures the greatest amount of heating surface, and at the same time allows for the unequal expansion of the tubes. One end of each pipe is screwed into a return bend and the other is fastened to the chamber by a long thread and lock nuts, making reliable steam joints, which may at any time be loosened if required. The tubes are also so arranged as to be readily cleaned from soot arising from the use of bituminous coal.

The construction of the grate needs no especial reference. The heated air in rising passes around the tubes and out between the back sections into the flue, and thence to the chimney. The roof of the fire space is lined with fire brick, above which a layer of any non-conducting material is placed. It is claimed that, owing to the large heating surface, increased rapidity of getting up steam and a consequent less expenditure of fuel are effected. We are informed that steam has been obtained from cold water in the period of fifteen minutes.

The water chambers are large enough to insure a free passage of the water, thus preventing foam and securing dry steam.

These boilers can be readily taken apart for transportation, put together by any engineer without injury to joints, and can be enlarged at will by adding sections. They are constructed double, as shown in the engraving, or single. In the latter case the form is easily understood by imagining the front sections, of the generator represented, to be removed. Corresponding alterations are made in other parts to accord with the single set of tubes, B, and chamber, A. The steam drum, N, is not used, the upper portion, L, of the sections answering the purpose.

The device in both forms, it is claimed, has been found well suited for high and low pressure, stationary, portable, and marine engines. It is also specially constructed for heating purposes.



THE ECLIPSE SECTIONAL STEAM BOILER.

We see by the Pittsburgh papers that Messrs. Jones & Laughlins, proprietors of the American Iron Works, have contracted with the Eclipse Steam Manufacturing Company for three large batteries of these sectional safety steam generators, of 240 horse power, to take the place of the four flue boilers which exploded on February 3. They have had a number of sections in use for a year, on trial.

Patented September 6, 1870. For further information address G. W. Bollman, President of the Eclipse Steam Manufacturing Company, 87 Wood street, Pittsburgh, Pa.

Scrap Iron.

Manufacturers should look well to their scrap iron; do not waste a piece, no matter how small; gather all together, assort, have different receptacles for steel, wrought, cast and malleable iron. The wrought iron from the carriage shop is the most valuable of scrap iron, but to bring the highest price there must be no malleable or cast iron mixed with it; every pound of scrap has a market value, and it should be packed in barrels or boxes and sent to market. If there be any considerable quantity, it will pay to send it to the mills and have it worked up into bars. It is the small manufacturers who do not take care of their scrap, but allow year after year to pass without paying any attention to it, and scraps of iron can be found all over their factories, while boxes and out of the way corners are filled with it, and hundreds of dollars of what would make the best of bar iron is allowed to go to waste.

Vertical Grist Mills.

The idea of placing the grinding stones on horizontal spindles, like common pulleys, is very old, but has never come into much use except for small mills, where coarse grinding and speed are wanted. It does not follow, however, that this plan cannot be successfully applied to the finer kinds of flouring. According to Leffel's *News*, "a vertical mill of somewhat novel character has lately been introduced, in which two or more pairs of millstones are combined on one horizontal shaft, or on sections of a shaft, and driven by one belt or gear, the power being applied directly to the shaft. No intermediate shafting is used, and the cost and care of a number of pulleys, belts, gears, etc., is thus in many cases saved by the adoption of such mill. Furthermore, the millstones are faced and furrowed on both sides instead of only one, and combined in groups of three or more. In a group of three the center stone is fast to, and revolves with, the shaft, with a stationary or bed stone adjusted on each side of it, making two mills out of three stones; and each of the three stones being interchangeable, there is afforded, practically, the grinding surface of three mills. As each stone is double faced, any one of the three may be taken out to be sharpened at any time and another put in its place, so that the mill can be kept running without interruption. If one more stone be added to a group of three, there will be three mills with four stones, or five stones will make four mills; and so on to any desired number, all being driven by one belt or gear, and occupying only one foot in length of shaft to each mill. It is argued in behalf of this arrangement that a group of five stones, making four mills, will occupy only the space usually taken by one mill, and that the four have only two bearings to care for, while the step so troublesome to millers is entirely done away with.

"There is evidently a very material saving of room in this arrangement, whatever may be its other merits or defects; and it must also be admitted that any device which enables the miller to simplify his machinery, dispense with complicated and costly gearing, and bring the work in close proximity to the power, is so far a very valuable gain."

Spontaneous Combustion.

In the last report of the Fire Marshal of New York city, sixteen recent examples of fires caused by spontaneous combustion are recited. During the year 1872, there were 1,380 fires in New York. How many were spontaneously caused, there are no means of knowing. Of the sixteen spontaneous cases above alluded to, nine originated among oily rags, cotton waste or rope materials, two in piles of coal, one in a mass of "excelsior" or fine wood shavings used for cheap upholstery purposes, one in salt hay, two in oily saw dust, one in rubbish.

NEW ELECTRICAL DISCOVERY.—Dr. Blake, of the San Francisco Academy of Sciences, and Judge Hastings, of the California State Geological Survey, announce the discovery of a current of electricity running north and south at a distance of about 150 miles from the Pacific coast, along a belt of metallic deposits, which serves as a conducting chain between the poles.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year		$3 00
One copy, six months		1 50
CLUB RATES	Ten copies, one year, each $2 50	25 00
	Over ten copies, same rate, each	2 50

VOL. XXVIII., No. 9. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, MARCH 1, 1873.

Contents:

(Illustrated articles are marked with an asterisk.)

SMALL POX.---OLD AND NEW REMEDIES.

Superficially considered, it appears singular that certain contagious diseases, especially small pox, spread more in the winter season (which, in other respects, is the healthiest time of the year) when the cold destroys the miasmata which flourish in tropical climes and, in hot summers, sometimes visit portions of the temperate zone. But in order to explain this apparent anomaly, we have only to consider that in winter a large number of the lower classes of people huddle together in ill ventilated rooms, in order to shelter themselves against the cold. Of course this is favorable to the growth of miasmata, which only need suitable conditions to propagate themselves. Microscopists have succeeded in tracing the origin of many contagions to parasitic growth, either vegetable or animal, and it is not improbable that this will ultimately be the case with all, the denial of many medical authorities notwithstanding. It should be kept in view that, formerly, equally high authorities used to deny most peremptorily, to several diseases, the origin which is now, beyond the shadow of a doubt, proved to be the true one, namely, the growth of animalculæ or vegetable parasites. It should also be considered that the fact of not finding such, in certain cases, is only a negative proof; they may be there and the investigator may have failed to find them; but other searchers in course of time and with instruments more perfect than we possess at present, or by help of an improved *modus operandi*, will undoubtedly discover them. Microscopic investigation has only just commenced to be applied in medicine, and the most advanced physicians know now that it is one of the most powerful helps in medical diagnosis.

Eruptive fevers are diseases of the blood; they probably originate in a kind of catalytic poison in the system, which may be a result of parasitic growth, as is the case with fermentation and many other chemical changes. However, the future will decide the question definitely; in the meantime we must observe, use our best judgment, and apply all the light, as far as the present state of science allows, to combat this class of diseases, among which small pox is one of the most virulent, loathsome and dangerous. In order to be fully convinced of this, one has only to visit a small pox hospital and see this interesting disease in all its stages.

In regard to the effectiveness of the protection afforded by vaccination, the statistics show that this discovery, made by Jenner more than a century ago, had the most startling influence in staying the small pox ravages of that time, and it kept the nations who accepted it comparatively free; the experience of the physicians of the present day tends in the same direction, and all doubt fostered by some in regard to its effectiveness proceeds solely from want of acquaintance with the facts, which are overwhelming in proof of its great value to the human race. As the health and longevity of vaccinated persons is on the general average equal to that of others who escape the small pox without vaccination, there can be no serious objection on that ground. The rule, laid down by some, that persons must be vaccinated every seven years is totally arbitrary and without any foundation whatsoever; different individuals will differ greatly in this respect, and, in order to be safe, it is well to try if vaccination will "take" in case any danger is apprehended, even if it has been applied only three or four years ago. If no epidemic is prevailing and the person is exposed to no danger, it is needless to revaccinate every seven years; ten years or more may elapse, and we have known individuals who undoubtedly, by a single effective vaccination in childhood, have been protected for their whole lives.

In regard to the treatment, it must be kept in view that here, as in all eruptive fevers, it must have its course, and cannot be cut short without robbing the patient entirely of his chance of escape. Careful guarding against taking cold, good nursing, the mildest possible diet, and abstinence from irritating food and remedial agents similarly objectionable are the first necessities of small pox cases.

The latest medical journals recommend two new remedies, which experience has proved to be beneficial. Dr. Revillod, of Geneva, recommends glycerin as an exterior application; this, through its soothing action, diminishes the intensity of the eruption. He mixes it with soap and some mercurial ointment. Dr. Carl Nagel, Royal Chancellor of Health in Berlin, recommends xylol; he has administered this internally in eighty cases, thirty-six of which had the small pox in its worst form, and only four died, which is a better result than that of any other remedy thus far known. When administered while the disease is but suspected, xylol does not prevent it, but greatly eases the patient and facilitates a speedy recovery.

Xylol, or xylen, is also called the hydride of xylenyl; it is one of the hydrocarbons obtained by the distillation of coal tar, wood tar, or Burmese petroleum. The coal tar contains little of this ingredient, but one pound of oil separated from crude wood spirit contains about one ounce of xylol. It is a liquid similar to benzol and toluol, but has the antiseptic properties of carbolic acid from coal, and of creosote from wood. It separates from the crude wood spirit by the addition of water, and is purified, like other cognate products, by sulphuric acid; the brown mixture, after standing, is washed with a solution of potash and then in water, dried over chloride of calcium or glacial phosphoric acid, and then subjected to a fractional distillation, when the xylol comes over as soon as the temperature has risen to between 258° and 266° Fahr.

It is well known that many derivatives of tar, creosote, carbolic acid, benzol, toluol, xylol, etc., are all poisons for small organic growths, either vegetable or animal; that they, for instance, at once destroy fermentation by killing the microscopic yeast plant; it is also known that mercurials are especially poisonous to parasites of all kinds, especially animal ones. These remedies now appear to be effective in small pox, and this raises the very natural question if it is not an argument for the probability of the theory that this disease also is due to a morbid organic growth, perhaps in the blood itself, which produces that violent fever, with the symptoms of pain, nausea, etc., and finally works itself out through the skin and mucous membrane by a copious eruption, which is often strong enough to destroy the skin like so many burns, and sometimes even so violent as to destroy the life of the patient, in the same way as an extensive scalding does, which is fatal by arresting the natural action of the skin, consequent to the annihilation of its organic structure.

In consideration of the excitement about the spread of small pox in this country, we believe the above details to be of general interest and utility to our readers.

A WORD WITH THE READER, THINKER, AND WRITER.

We believe that there is no portion of our journal of greater interest than the columns devoted to our correspondence, and we should be unappreciative did we undervalue the practical suggestions and information imparted by its writers. We would take the present opportunity of requesting from our readers even more frequent communications. Let us have all possible ideas. Criticise everything that appears open to criticism; and, if experience has taught you differently, give the public the benefit of your wisdom. The mere fact of your finding any difficulty in committing your knowledge to paper need be no drawback. We want ideas, not words; and if the brain work is there, we will put it into proper shape. Every week we publish a large number of questions on different subjects. Sometimes we are at a loss for a suitable reply which many of our readers can readily find; in such cases responses from our subscribers are appreciated both by the enquirer and ourselves.

The modern newspaper is the substitute for the ancient forum. Instead of a number of people meeting in some public place, as they used to do, and discussing various questions of interest, they now write to their paper and interchange their views through the medium of its printed pages.

Necessarily, among the multitude of communications which reach us, there are many agreeing on some single topic. In such case we exercise our discretion in the publication of such as we consider the most sound and suitable. There are others devoted to the discussion of questions which it is only a waste of time to consider. We allude to perpetual motion, quadrature of the circle, and all of that class. We would earnestly impress upon all who entertain such chimerical ideas to turn their minds and labor to more profitable pursuits.

We believe that there is no better way of acquiring and and disseminating knowledge than to establish a co-operation between those who read and those who write—to place the opinions of the practical man beside those of the theorist, the worker beside the thinker, and thus obtain views clearer, better, and more comprehensive on subjects interesting alike to all.

THE PHOTOMETER APPLIED TO ASTRONOMY.

In a recent article on the physical nature of the planet Jupiter (see page 400 of our volume XXVII), we described the important results deduced from photometric observations of that planet; and we may add to this that photometry has often been applied to the starry heavens, in order to determine the comparative luminosity of the heavenly bodies. It is evident, however, that the common methods as applied here on earth to compare the relative intensity of different flames, and of which one was described on page 83 of this volume, are entirely inapplicable; and therefore other modes must be applied, and photometers based on totally different principles must be resorted to.

The most perfect photometer adapted to measure and compare the light of the heavenly bodies is undoubtedly that invented by Zöllner, the famous astronomer and spectroscopist of Berlin; he invented it as early as 1860, but only recently has he applied it extensively to celestial photometry. It is based on the principle of the polarization of light; and in order to accomplish his purpose, he makes use of the property of the analyzer (see Tyndall's lecture, page 35 of our current volume) to transmit or obstruct the polarized ray in proportion as it is turned round an arc of 90°; for intermediate portions of the angle of rotation, a strong light may be gradually diminished till the transmitted rays are equal to the weaker light.

The first thing Zöllner had to do was to determine how far the angle would serve as a measure for the intensity of light. Mathematical theory teaches that the amount of light transmitted does not increase as the angles themselves, but as the squares of their sines. Zöllner found this law perfectly verified by practical experiment, in testing this photometer in many different ways. By attaching such a polarizing photometer to an astronomical telescope, he has been enabled to determine the comparative luminosity of divers heavenly bodies with greater accuracy than had previously been possible; and the results obtained will especially be most interesting to posterity, who will be able to determine what changes have taken place in the course of time, changes which are sometimes very great and of the utmost importance to the extension of our knowledge of the nature of the heavenly bodies.

As a standard of comparison, he uses the light of a lamp shining through a pin hole; and in order to be independent of the perhaps variable light of this lamp, which may differ on different nights, he compares two stars with the lamp, and only notices the difference between the stars. If, for instance, the planet Jupiter has to be compared with Venus, he directs the telescope to Jupiter and turns the analyzer till its luminosity is equal to that of the lamp shining through the pinhole, and finds it was turned, say, 10°; then he directs the telescope to Venus, and finds that he must turn it 25° in order to diminish its light till it is equal to the lamp light. The relative luminosity will then be as the square of the sines of these angles, that is, as $0{\cdot}0174^2$ is to $0{\cdot}0389^2$, or as 0·00030276 is to 0·00151321, or, approximately, as 3 to 15 or 1 to 5.

Among the results thus obtained by Zöllner are the following:

COMPARISON OF PLANETS.

The fixed star *Capella* as compared to Mars is as 1 to 7; to Jupiter, as 1 to 10; to Venus, as 1 to 50; to Saturn, as 1 to 0·4; to Uranus, as 1 to 0·0066; to Neptune, as 1 to 0·0007.

COMPARISON OF FIXED STARS.

The same star *Capella* as compared to *Sirius* is as 1 to 5; to *Vega*, as 1 to 1·2; to *Betelgeuse*, as 1 to 0·5; to *Regulus*, as 1 to 0·4; to *Pollux*, as 1 to 0·3.

THE MOON COMPARED TO THE PLANETS.

The full moon as compared to Venus, when full, is as 150 to 1; to Jupiter, as 700 to 1; to Mars as 1,000 to 1; to Saturn, as 18,000 to 1; to Uranus, as 1,159,000 to 1; to Neptune, as 10,000,000 to 1.

The sun as compared to the moon is as 700,000 to 1. Consequently the light of the sun surpasses that of the most distant planet, Neptune, 7,000,000,000,000 times.

DISCOVERIES OF TIN IN QUEENSLAND.

The most recent reports substantiate the fact that tin fields of unexampled richness have been discovered in the English colony of Queensland, Eastern Australia, the presence of the metal being detected over an area of 550 square miles. Mr. T. F. Gregory, the mineral land commissioner, states that, at the present time, only about 225 square miles of this area have hitherto been found sufficiently rich for working, but there are many instances of tin being found in paying quantities beyond these limits. The physical and geological character of nearly the whole of the area described is that of an elevated granite table land, intersected by ranges of abrupt hills, the highest limits of which are about 8,000 feet above the sea, its eastern escarpment forming the water shed of the Clarence river, the northern that of the Condamine, and the southwestern, the Severn and McIntyre rivers. The portion of the district over which the deposits of tin ore are distributed is that comprised by the water shed of the Severn river. The richest deposits have been found in the stream beds and fluvial flats, the paying ground varying from a few yards to five chains in width, occasionally broken by rocky bars; but even in these instances large deposits are frequently lodged in the pockets and crevices between the granite boulders.

The probable yield of ore is stated at ten tuns per lineal chain of the beds on the various creeks. In some instances, this has been found to extend to thirty tuns per chain. Regarding the mineralogical character of the rocks, it is stated that the ore is associated only with granite which is invariably red. The granite generally is coarse grained and seems to disintegrate rapidly under atmospheric influence. There are numerous bands of loosely aggregated rock, granitoid in in character, highly micaceous and traversed by bands and veins of quartz in all directions, in which the crystals of tin are abundant. No tin floors, as at the Elsmore mine in New South Wales, have yet been discovered.

As the lodes and veins have as yet been but very partially tested, it would be premature to give any decided opinion upon them. It is probable that they will prove a source of great wealth, and perhaps render Australia one of the first tin producing countries in the world.

A FEW GRATUITOUS HINTS TO INVENTORS.

It often happens that the germ of an important discovery is contained in a short paragraph; but as it is the early bird that catches the worm, so it is only the most alert reader that seizes upon the obscure fact and appropriates it to his own use. We have inserted a short notice of a number of discoveries which we hope to have brought back to us in matured plans for their application; but, for fear that some of them may have escaped the vigilance of our readers, we refer to them again in a more conspicuous manner by way of gratuitous suggestion.

Has the cupro-ammonium solvent for cellulose been employed on a large scale in the manufacture of artificial wood, water-tight paper, incombustible fabrics and the like? The name may frighten many persons from paying the regard to this important reagent which it deserves. It is very easy to make it, as it is only necessary to keep strips of copper standing in concentrated ammonia, occasionally shaking it to admit the oxygen of the air. Oxide of copper is produced, which dissolves with a blue color in the ammonia and gives the reagent sought. There is certainly a large scope for invention in the use of this material. Paper bags can be rendered impermeable to water by immersing them for a few moments in cupro-ammonium and running them between rollers. They can then be substituted for parchment for many purposes. If numerous sheets of paper were to be similarly prepared and pressed together, thick layers of great lightness would result, which could be employed as a substitute for wood in architectural structures and interior decorations. By impregnating the wood paper with tungstate of soda, it would be rendered wholly uninflammable, and in this manner theatrical decorations, and the packing surrounding steam pipes and boilers, could be made of it; and in its fireproof form, it is capable of a wide range of application which the inventor must think out for himself. It is said that paper bands, nearly as strong as leather, can be made on the same plan. The cupro-ammonia paper would find application for roofing, water pipes, hats, boats, clothing, collodion; and as all kinds of cellulose are attacked by this reagent, much waste material, such as seaweed, grass, sawdust, shavings and rags, could be applied to many purposes. It is a question whether, by combining cupro-ammonium and tungstate of soda, wood and timber could not be rendered fireproof as well as waterproof and otherwise indestructible. There is evidently a wide field for research in this matter, and it would be well for inventors to give it attention.

There is another question which sometimes occurs to our mind, which is this: Are there any practical applications of thallium in glass making and otherwise? Lamy exhibited a specimen of thallium glass at the Paris Exhibition of 1867, possessing a higher index of refraction than anything of the kind that had been previously made. Since that time a considerable quantity of thallium has been found in the various stages of metallurgical processes, and enough material could be found if there was any call for it. The whole astronomical world is turning its attention to the use of the spectroscope in observations on the stars: and it is of great importance to employ a highly refracting medium. Lead glass answers a very good purpose; but if thallium glass is better, it ought to be tried. For optical instruments of all kinds, a new material of this character would always prove most serviceable. The employment of thallium in medicine and in colors is also a matter to be investigated.

A third suggestion we have to make is in reference to new applications of copal. We have seen it stated that gum copal can be vulcanized, so that it becomes very hard and closely resembles amber, for which it can be substituted for many purposes. The vulcanized amber can be turned on a lathe and is said to possess great durability. In what way the process is accomplished has not been disclosed. It appears to be worthy of examination.

The above are some of the paths that might be taken by industrious students in their search for new applications, and we commend them as being worth pursuing.

PROFESSOR AGASSIZ ON OUR COLLEGES.

Professor Agassiz has evidently no very high opinion of our educational institutions, and publishes his adverse views with characteristic freedom. He says our colleges are nothing but high schools, and that even Harvard is far from being a university; while the knowledge imparted is "the traditionary learning of the middle ages," and only "the dregs of scholarship."

In common with all progressive lovers of science, Professor Agassiz strongly advocates a freer scope being given to the study of nature. This branch of education should begin in childhood, and not nominally be taught in normal schools from text books which are often unsuitable. With regard to our system of popular education, he acknowledges that it is better than the European, but declares that the substance is wanting.

It is probable that these ideas, from so eminent an authority, will give new impetus to the war of science against classics which, for some years past, has been waged in our colleges. That there is a strong and growing popular taste for science is amply evidenced by the interest manifested in the discourses of Professor Tyndall and the writings of other distinguished savants; but that, at the same time, there exists, even among people otherwise well educated, an inexcusable ignorance in scientific matters, is equally true. That the latter is, in a great measure, due to the imperfections of our college courses, we consider there is little doubt, and we adhere to the belief that, were the classics in our seminaries made subservient to the thorough study of the ordinary principles of science, the graduates would leave their books much better prepared to encounter the world.

DRAPER AND TYNDALL ON THE INVISIBLE RAYS.

To the Editor of the Scientific American:

In your issue of February 1, you gave an abstract of Professor Tyndall's lecture on "The Invisible Rays," in which I find the following statements: "On both sides of the spectrum there is a copious overflow of rays which are incompetent to excite vision, but which, however, are able to agitate the molecules of certain substances so as to shake them asunder and produce chemical decomposition," and, further on, "it is shown that the heat radiated from the non-luminous portion is seven or eight times as great as from the luminous or visible." The latter proposition is illustrated by a well known figure in which the invisible rays are represented by a curve very large in comparison with a similar line indicating the visible rays. In the same number of your journal you publish Dr. J. W. Draper's researches in actino-chemistry, in which the author says: "As Dr. Draper demonstrated the heating power of radiation to reside in all equally, whatever their refrangibility, so in this he proves the power to produce chemical changes to be manifested by rays of every refrangibility, different substances being acted on by different rays." The discrepancy apparently existing between the views of Drs. Draper and Tyndall, thus plainly indicated by the two articles from which the above extracts are made, has led me to obtain a more extended report of the investigations of the former physicist. The conclusions therein contained seem to me to be flat contradictions of Professor Tyndall's assertions, as proved by the following: It follows that the true distribution of heat throughout the spaces of the spectrum is equal, and that "the figure so generally employed in works on actino-chemistry to indicate the distribution of heat, light and actinism in the spectrum serves only to mislead. The heat curve is determined by *the action of the prism, not by the properties of calorific radiations*; the actinic curve does not represent any special peculiarities of the spectrum but the habitudes of certain compounds of silver."

Can you or any of your readers reconcile such completely opposite ideas? How is it that Professor Tyndall did not allude to so radically different a theory, of the existence of which he must have been aware, in the course of his lectures? When such eminent and learned doctors disagree, it is indeed a question who is to decide. A PERPLEXED PHYSICIST.

REMARKS BY THE EDITOR.—The discrepancy between the views of Dr. Draper and Dr. Tyndall, pointed out by our correspondent, did not escape the attention of scientific men during the visit of the latter to this country; and the subject was frequently discussed by them without the friends of either party being able to reconcile the differences. Dr. Draper, we are told, is disposed to think that the spaces in and out of the spectrum measured by Dr. Tyndall were so small that the chance for error was a very close one, and he intimates that an error was probably committed. On the other hand, Dr. Tyndall does not appear to believe in Dr. Draper's results. We suspect that Professor Tyndall did not allude to the radically different theory, of which he was fully aware, partly because it might have been considered a breach of hospitality and partly because the rostrum of a public lecture is not the place for the discussion of such nice points of physics. The question is one which can only be determined by actual experiment. The learned doctors must repeat their observations, and, if they still disagree, let a high court of arbitrators appoint competent physicists to go carefully over the same ground and report the results to a scientific congress. We take the opportunity to say that, in our opinion, Dr. Draper has never received the credit that fairly belongs to him for his early researches in prismatic analysis. In the *Philosophical Magazine*, for May, 1847, and February, 1848, are contained papers "On Methods for the Prismatic Analysis of Substances," in which will be found foreshadowed Bunsen's application of the spectroscope to chemical analysis. Bunsen at first proposed to substitute prismatic analysis for flame analysis as an aid to qualitative chemistry. In this he had been anticipated by Draper, but Bunsen went further and discovered a new element; that event fixed the method beyond all possibility of being forgotten, and Kirchoff clinched the matter by his magnificent researches in solar chemistry. Still it must not be forgotten that Draper pointed out this line of research fourteen years before Bunsen took it up, and that if he had not been loaded down with the cares of administration and the toil and drudgery of teaching, he too might have pursued it to such a degree of perfection that no subsequent doubt could have arisen as to his share in the great discovery. The present is a good time to revive these points of history, and to accord credit where it belongs.

RAPID TRANSIT IN NEW YORK.

The venerable Peter Cooper of New York has sent to State Senator Tiemann a new scheme to secure rapid transit in New York, which consists in locating a double railway track in the second story of the buildings along the line of the route. On these tracks he proposes to place a string of light cars in the form of an endless belt, to be moved by endless ropes. There are to be just as many cars as are required to move the vast numbers of people who are expected to patronize the work. The right of way is to be purchased by the corporation, to the stock of which, if placed in proper hands, Mr. Cooper engages to subscribe the sum of one hundred thousand dollars.

Peter Cooper, as all our readers probably know, is one of our most highly esteemed, generous, and practical fellow citizens. He rarely recommends to others a scheme in which he does not himself liberally engage. He was the originator of one of the earliest locomotives ever built in this country, and from that machine down to and including the Atlantic Telegraph Cable, to which he was one of the original contributors, he has been an assistant in many highly useful and successful enterprises. The Cooper Union Buildings, which have now for several years afforded the most splendid opportunities for education, free of charge, to working people, by its evening classes as well as day privileges, was a gift from him to our city, and will ever be a monument to his fame. Whether his present plan for rapid transit is ever brought into practice remains to be seen.

Mr. Speer and friends, whose plan for the Traveling Sidewalk was illustrated not long ago in the SCIENTIFIC AMERICAN, are also applicants before the Legislature for a charter intended to afford rapid transit to our citizens. They would like the privilege of erecting their improvements on posts over the present sidewalks on Broadway. The route is a good one. The plan of Mr. Cooper is somewhat analogous to this. The Traveling Sidewalk consists of an endless moving belt, in the form of a floor, on which settees and chairs are placed. You step on board the floor and away you go, and step off wherever you like. No stoppages.

Another new plan for rapid transit in this city is the "Mid-Avenue Elevated and Surface Railroad," of John B. Church, who proposes to erect a railway on iron columns in the center of some street to be selected for that purpose. He thinks that such a road can be built strong enough to carry trains and locomotives at a speed of thirty miles an hour, for three hundred thousand dollars per mile, the right of way being granted free by the authorities. This is lower than any estimate we have heard of. The estimate, we believe, for the Gilbert elevated railway, which, by the way, it is said is shortly to be built here, is from seven hundred thousand to one million dollars per mile. The construction is substantially what Mr. Church proposes, that is, in the street, on iron columns. We think that Mr. Church will find that one million dollars per mile are more nearly correct figures than those he has given.

Still another scheme for rapid transit is proposed by a party of citizens who desire to have some of their number receive authority from the State to manage the road, the money to build with to be supplied from the city treasury.

Meantime, while these various plans are being talked about, the committees of both branches of the State Legislature have unanimously recommended the passage of the bill authorizing the Beach Pneumatic Transit Company to go ahead and complete their railway under Broadway. When this bill passes we shall have a practicable route authorized for an underground railway, the construction of which costs one million dollars per mile, the same as the elevated; and it will be a valuable acquisition to rapid transit facilities in New York. In London the underground railway is very popular, and carries between fifty and sixty millions of passengers per annum.

SCIENTIFIC AND PRACTICAL INFORMATION.

PORTABLE DRY INK.

At a recent meeting of the Frankfort Polytechnic Association, Professor Boettger exhibited a novel kind of ink, which is admirably adapted to take on journeys and exploring expeditions. White blotting paper is saturated with aniline black and several sheets are pasted to form a thin pad. When wanted for use, a small piece is torn off and covered with a little water. The black liquid which dissolves out is a good writing ink. A square inch of the paper will give enough ink to last for considerable writing, and a few pads would be all that an exploring party need carry with them. As water is always available, the ink is readily made.

TO CLEAN SILVER.

Dr. Elsner says that hot water poured off potato parings or boiled potatoes is admirably adapted to clean silver. The objects can be easily rubbed by the fingers with the settlings of potato meal, and they become as bright as they usually do when rubbed with tripoli. The process is particularly advantageous for engraved and raised objects, where the powder is liable to collect in the cavities. German silver and plated ware can be cleaned in the same way. Potato water which has become sour by long standing can be substituted for acids to clean copper vessels.

NEW USES OF HYDRATE OF CHLORAL.

The hydrate of chloral, which is now made on a large scale, has been found to be useful for other purposes than the original one of a hypnotic. It is said to be an excellent antiseptic; it stops fermentation and destroys germs that would be likely to develope in organic substances. One per cent of hydrate of chloral will prevent the decomposition of glue and albumen for a great length of time. Another use of hydrate of chloral is as a reducing agent. It is said to precipitate metals from solutions, and this property suggests its possible application in photography and for depositing metals.

AN INDELIBLE RED INK.

Dr. Elsner states that an indelible red ink can be prepared as follows: Equal parts by weight of copperas and cinnabar, both in fine powder and sifted, are rubbed up with linseed oil with a muller and finally squeezed through cloth. The thick paste can be employed for writing or stamping woolen and cotton goods, and the color remains fast after the goods have been bleached. The reds usually employed are not fast colors, and do not resist the action of bleaching agents.

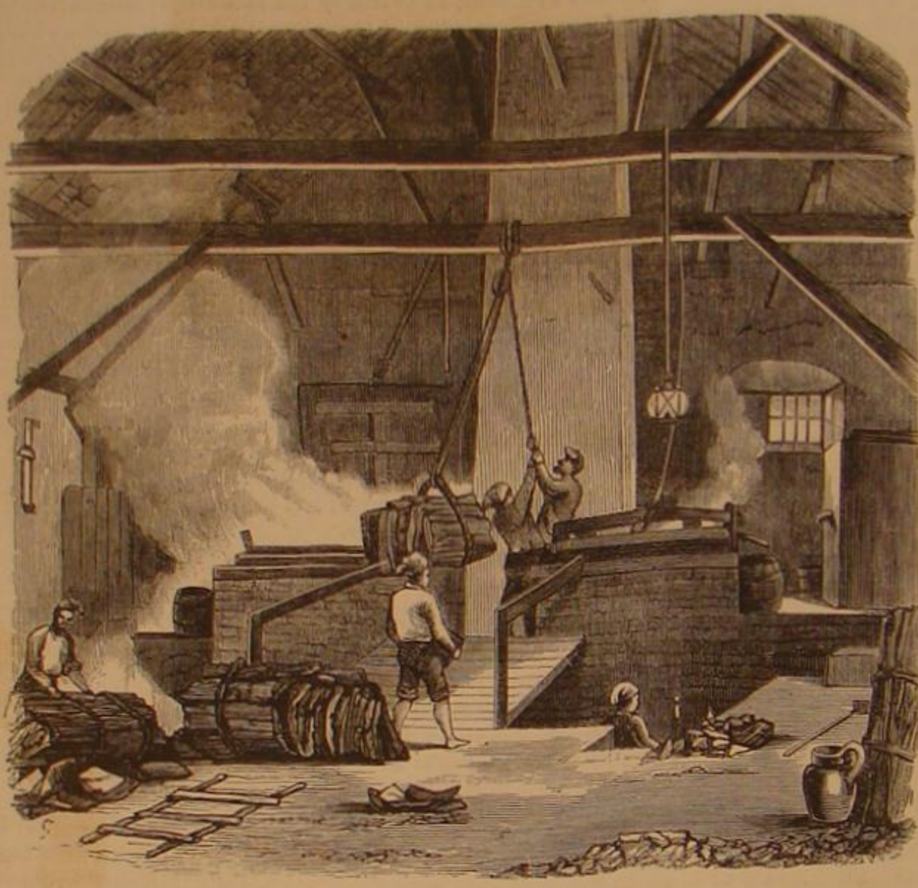
THE TRANSIT OF VENUS.

The planet Venus, it has been calculated, will apparently cross the disk of the sun on December 8, 1874. A full explanation of this important astronomical event, and of the nature of the knowledge which, it is expected, will be derived from its observation, will be found in Professor Young's excellent lecture on "Our Present Knowledge of the Sun" on another page of this issue.

SORTING CORK FROM THE ROUGH BALES.

BURNING THE OUTSIDE OF THE COMMON CORK WOOD

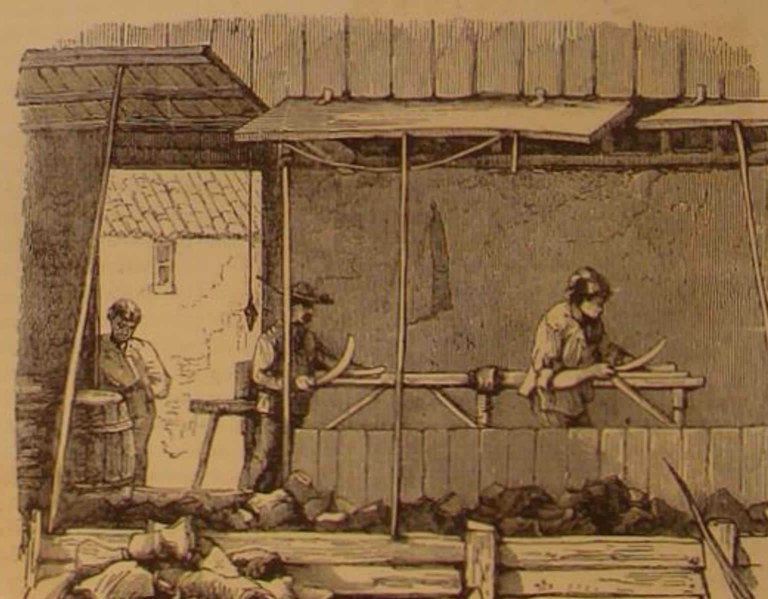
CORK TREE WITH BARK ON.



THE CORK BOILING DEPARTMENT.

CORK TREE PARTLY BARKED

SCRAPING THE CORK WOOD AFTER BOILING.



FACING THE CORK WOOD FOR THE MARKET.

CORK PRODUCTION AND MANUFACTURE IN SPAIN.

CORK CUTTING IN SPAIN.

The recent political revolution in Spain, involving the voluntary abdication of the throne by the late King Amadeus, and the almost unanimous adoption by the Cortes of a Republican form of government, imparts a new interest, for Americans at least, in the industrial resources of that wonderful country. Not least among these resources is the production of cork.

The cork tree is found in its wild state in the south of Portugal, Africa and Spain. In the latter country the preparation of the bark for foreign markets is one of the staple industries, furnishing labor and subsistence to a large proportion of the population.

The tree is a peculiar kind of oak, and the cork is the soft cellular interior bark, lying just inside the exterior woody covering. It is removed by making several longitudinal clefts up and down the trunk, and then girdling the latter with horizontal incisions. This operation is not performed, however, until the tree has attained a certain age, generally fifteen years, and the first crop is employed only for inferior purposes. Seven years afterwards the tree will have another coating of bark, which is stripped and used for making corks, and so on every five to seven years, according to the quality of the ground. The tree does not suffer from the process of scraping as it generally lives from one to two hundred years.

Between the cork and the tree, there is another bark that is used for tanning; but this is only removed when the tree is cut down. It is a curious fact that if any portion of this inner coating be destroyed, further formation of the cork on the injured spot ceases. After the layers of the cork are stripped, they are inspected and assorted, according to their sizes and quality, those of the finest texture being of the greatest value. The inferior portions are generally sorted out, their crust burnt off and sold mostly for floats, thus receiving the name of fishing cork. The better qualities are first boiled and scraped, and then blackened over a coal fire tho object being to make the surface smooth, and at the same time to conceal flaws. Some varieties, generally the best, are faced in order to exhibit the fineness of their texture. All these various processes will be found graphically depicted in engravings given herewith. After being for warded to the warehouses, the largest slabs are cut into pieces of about three and a half feet in length, eighteen inches in width and ranging from one half inch to three inches in thickness. Drying and packing in bales weighing one hundred and fifty pounds each follows, and the cork is ready for exportation.

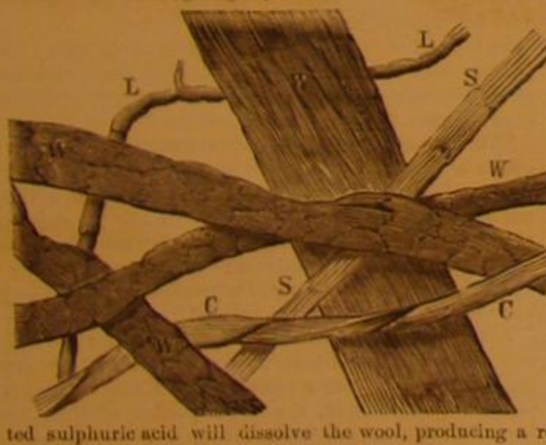
From five to twenty-five cents per pound is the usual price paid by the cork cutter in this country for the rough material as it arrives in the bale. It then undergoes another assorting, and a thorough steaming, in a chest designed for the purpose, the latter process softening the cork and rendering it easy to cut. To divide the substance special machinery is employed. Rapidly revolving circular knives are used, which cut by a drawing motion, as crushing strokes simply break the cork or cause it to crumble. The workman sitting in front of the machine places a piece of cork of suitable size in a revolving spindle by which it is firmly held. This spindle is raised a measured distance and the edges of the cork come in contact with the rotating knife, which smooths them off and leaves its work in a perfectly cylindrical form. Another method is to place the rough bits of cork in grooves on the circumference of a wheel which, working automatically, carries each piece to a point where its ends are received by a small lathe. The cork is then revolved slowly while a large circular knife removes a thin shaving, thus giving it the necessary taper, and a surface as true and smooth as if sand-papered. As fast as a cork is finished by the automatic lathe it is released and another substituted in its place.

Every portion of the material is utilized, either as stuffing for cushions or life preservers, or as a non-conducting substance for placing between walls or floors of buildings to deaden sound.

It has been estimated that it would require 4,000 men to be continually at work to supply New York alone with corks, if all had to be made by hand. There are at present 60 manufactories in the United States, cutting and supplying corks to the value of $2,250,000 per year.

TEXTILE FIBERS UNDER MICROSCOPE.

The present large demand for textile fabrics has led, not only to the discovery and application of new fibers, but also to several improved methods of disintegrating old rags that the fibers may be respun and used, either by themselves or in combination with new material. Wool thus treated is called shoddy, and its use has long been a common practice with makers of the lower qualities of woolen cloth. But as yarns are now spun for the making of mixed fabrics, wool, silk, cotton, and linen are so intimately blended that they all appear in the same thread, and a close examination with the microscope is necessary to detect the presence and the proportion of any of the four. Using a power of from 100 to 150 diameters, we observe, as in the engraving, the scaly hairs of wool, W, the smooth thread of silk, S, the cylindrical fiber of linen, L, or the spiral one of cotton, C, the colors of these varying considerably. When the presence of all or any of the four has been observed, a further test may be made by adding a drop of the ammoniate of peroxide of copper; by this salt, silk and cotton will be immediately destroyed, linen will gradually follow, and wool only will remain, its fibers being slightly increased in size. Concentra-



ted sulphuric acid will dissolve the wool, producing a red color. The next step in the investigation is to determine whether some or all of the fibers of the wool have been previously used. This is shown by the differences of the dyes, as the microscope enables the observer to discriminate between indigo, purpurine, madder, aniline, and any other dyestuff that may have been used, and worn fibers show traces of the bleaching to which they were submitted before being treated for a second process of manufacture. Another test for old fibers is the irregularity of their diameters, and the disappearance, in places, of the surface scales. A still further method of detection is the application of a lye of potash or soda, which attacks old wool with a rapidity to which new material is inaccessible.

To ascertain the proportion of old fiber in any mixed fabric, the threads should be laid as nearly parallel as possible. A power of from 20 to 50 diameters is sufficient to enable the investigator to count the fibers, the relative number of each being shown by the appearances above described. The chemical tests already mentioned will reveal at once the composition of the fabric to a careful observer. But there is obviously room for an improved method of distinguishing the different materials, and the importance of the interests engaged in the manufacture will probably induce the scientific world to bestow some attention on the subject.

TURPENTINE to be good should be as clear and white as water, of a strong penetrating smell, and very inflammable.

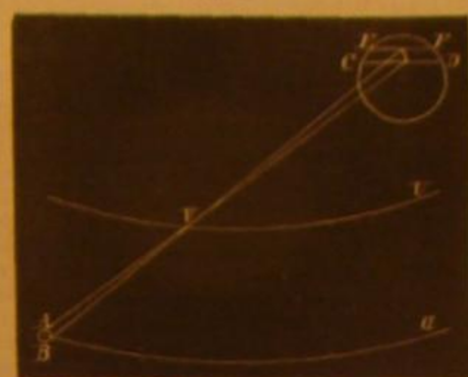
OUR PRESENT KNOWLEDGE OF THE SUN.

Professor C. A. Young concluded the annual course of lectures before the American Institute by an interesting and able discourse on the above topic. Modern science traces to the sun almost the whole range of terrestrial activity. We can easily follow out the solar action in our winds and no less easily in our waterfalls. The pumps that raise water to the hills are in the sun. The power that is expended in intercepting water in its downward flow is at the expense of solar fires. In a more remote way we may trace to the sun the steam power which is derived from fuel. The very force with which we move our limbs, the sound of our voices, even the power of mind, the impulses exerted in forming thought, in exciting emotions, are sun-derived, when traced to their ultimate source.

DISTANCE OF THE SUN.

The first point to be ascertained in relation to the sun, or indeed to any of the heavenly bodies, is its distance from the earth. The method of actually measuring the intervening space which can be most relied upon is by means of the transit of Venus. The planet will meet the eastern side of the sun's disk near the northern edge and will pass obliquely across. In Fig. 1, A and B represent stations on opposite

FIG. 1.



sides of the earth and *a* a portion of the earth's orbit. V is the planet Venus and *e* a portion of its path. C D and E F represent the apparent paths of the planet across the sun's disk. Fig. 2 shows the track of Venus more clearly. The upper and dark circle represents the planet as seen from the southern hemisphere, and the lower light circle, the planet as seen from the northern. The arrow shows the direction of the motion. The problem is to measure the distance between the center of the black dot on the great face of the sun to the edge of the latter with the utmost accuracy. An error of a hundredth part of a foot, at a distance of about 40 miles, would be fatal to any increase of the accuracy of our present knowledge.

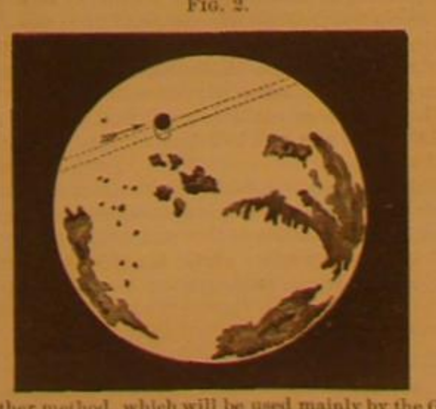
STATIONS ON THE EARTH.

The earth must be regarded as seen from the sun the moment when the planet strikes the disk of the sun, provided an observer on the earth were at its center. At that moment we must suppose ourselves transported to the sun, looking toward the earth. This will show the apparent path of the shadow of Venus upon the earth. Stations are selected around the edges of the world, all along in Japan, Kamschatka, Siberia, China and Siam in the northern hemisphere, and in New Zealand and some islands in the Southern Ocean.

METHODS AND INSTRUMENTS EMPLOYED.

In measuring this distance, there will be three different methods pursued. The old fashioned way was to note when the planet strikes the sun and when it leaves it, from which we may know the number of hours it takes to pass across the disk of the sun. Thus at the northern station we have the length of the chord which it passes over, and the same at the southern station; and knowing the length of the two chords it is not difficult to compute the distance between them. Sir George B. Airy, the Astronomer Royal of England, is disposed to rely mainly upon that method. But there are great difficulties with it. The main difficulty is this: A bright object looks to the eye larger than its real size; and a dark body projected upon it looks smaller than its real size, so that it is difficult to determine the precise moment when the planet enters upon the sun's disk.

FIG. 2.



Another method, which will be used mainly by the German astronomers, is to measure the position of this spot from time to time in reference to the edges of the sun's disk by means of the heliometer, an instrument by which we can measure very accurately the distance of the little round spot from the edge of the bright circle on which it will be shown. The other method, which will be used by all the nations, but will be mainly relied upon by the French and the Americans, is by photography. The English will use a common telescope, driven by clock work, with an eye piece to enlarge the image of the sun to about four inches in diameter. With this they will from moment to moment take photographs of the solar disk while the transit is going on, and they will afterward measure those photographs. The objection to this method is that the eye piece used to enlarge an otherwise too small image almost invariably produces a certain amount of distortion. The round image will not be round on the glass or paper, and it is very difficult to allow for that distortion. They propose to photograph with the same apparatus a scale of equal parts, putting up a board perhaps as long as this room, with laths nailed upon it at equal distances, to be photographed, and thus they propose to calculate, by comparison, the distortion of the different parts of the field of view. The Germans will use a telescope of the same kind and an eye piece of the same kind; but at the focus of their telescope they will place a piece of glass ruled with fine lines into squares. These will be measured beforehand very carefully, and the image of the sun and these ruled lines being photographed together, if there is any distortion it will affect these little squares precisely as it affects the sun; and they need only refer their measure to the nearest lines of this network to get an accurate result.

The best plan will be that pursued by the French and the Americans and by Lord Lindsay's party from England. The telescope will be 30 or 40 feet long—it need not be very large in diameter—and the image will be large enough not to require enlargement. Of course such a telescope would be very unwieldy if mounted in the usual way; and the method proposed is to put the telescope horizontally, perhaps in a tunnel underground to protect it from currents of air, though that is not essential, and to throw the image of the sun into the object glass by means of a flat mirror. In this case "flat" means a great deal. It is very difficult to make a mirror flat; and that is the difficulty in this method. The mirror must be so flat that at no point shall the curvature equal a radius of 18 miles.

NATIONAL EXPEDITIONS.

Russia will establish 25 stations in her Siberian dominions. France will send expeditions to Palestine, the Red Sea, Pekin and Japan, the island of St. Paul, New Caledonia, and possibly to the Sandwich Islands. The Germans will send to the Falkland islands, McDonnel's Island, and Kerguelen's Island, in the southern hemisphere. The English will send to Oahu, to Roderick's Island, to the Falkland islands, and to Alexandria, in northern India. Lord Lindsay will send a private expedition to Mauritius. The United States will

FIG. 3.

send out eight parties; four to Japan and China, and the other four to New Zealand, the Falkland islands, Van Diemen's Land and possibly Kerguelen's Island.

ILLUSTRATIONS OF THE SUN'S DISTANCE.

At present we consider the distance of the sun from the earth to be 92,000,000 of miles, with a margin of error of about 500,000 miles. It would take a railroad train 263 years to move from the sun to the earth; so that if the Pilgrim Fathers had started from the sun at the time they started from England, by a train whose only stopping places would be Mercury and Venus, they would not have arrived yet. It would take a cannon ball, going at full speed, about nine years to make the journey. Light takes eight minutes. Sound, if it could be carried over the celestial spaces, would be fourteen years on the way. You know, continued the lecturer, that if you touch a part of the body, one does not feel it instantly. If you touch the hand of any one with a pin, it will be an appreciable part of a second before he will feel it and draw his hand back. Now if I had an arm long enough to reach to the sun, and should put my fingers into the solar flame and burn them there, it would be one hundred years before I should find it out, and another hundred years before I could remove my hand.

DIMENSIONS AND DENSITY OF THE SUN.

Once having found out the distance of the sun, it is very easy to find out its diameter, which is about 860,000 miles. If the earth were represented by a ball 2¼ inches in diameter, the sun would require a ball of 18 feet in diameter, which would just about lie between this stage and the ceiling. If the earth were placed at the center of the sun, the moon would be so far inside the sun's surface that there would be almost room for another moon beyond, the distance of the moon from the earth being 240,000 miles, and of the surface of the sun from its center, 430,000 miles. In bulk, the sun is a million and a quarter times larger than the earth; that is, it would take that number of earths rolled into one to make up the bulk of the sun. It would not take that number to make up the weight of the sun, for the sun is lighter, bushel for bushel, than the earth. It weighs about 325,000 times as much as the earth. With that enormous mass, the force of gravity must be 28 times as great as on the surface of the earth; so that the weight of an ordinarily heavy man on its surface would be about two tuns.

THE HEAT OF THE SUN

is estimated by French physicists to not greatly exceed that of the electric arc, being, perhaps, once and a half or twice as great. Secchi, on the other hand, estimates it at 2,000,000° Fahr., and Ericsson at from 6,000,000° to 7,000,000°. Sir John Herschel illustrates the quantity of heat given out by the sun, as determined by his experiments, as follows: Suppose ice should be formed into a rod forty-five miles in diameter, and that rod of ice should be darted at the sun with the velocity of light: if all the heat of the sun could be concentrated upon the point of that advancing javelin of ice, it would never approach the sun, for the point would melt off as fast as it came. Or we may put it in another way: Suppose we should build a railroad from here to the sun, and should take to it two and one quarter miles square of solid ice, carrying it clear by the moon, Mercury, and Venus, and if we should concentrate upon that the heat of the sun, it would take just one second to melt it, and in seven seconds it would be volatilized, changed into steam, and invisible.

THE ORIGIN OF SOLAR HEAT

has been attributed by some to chemical combinations, but if the sun were of solid coal, it would have been completely burned out in 5,000 years, giving out heat at the present rate. The proper view is that its heat is maintained by the influx of matter. As meteors fall upon the earth, several millions in a day, so they fall into the sun, millions of millions per day, and contribute to the solar heat. But that does not account for it all. Another cause, I doubt not, is the contraction of its volume. If the sun were to contract one hundred and twenty feet in radius, or two hundred and forty feet in diameter, in a year, that would account for all the heat it gives off. Bodies may give off heat without growing colder. If we freeze a pail of water, it gives off heat while it is freezing, but the thermometer will indicate no fall of temperature until it is all frozen. So it is quite likely that the gases in the outer surface of the sun will enter into combinations with each other, dissociating and uniting in other forms, and emitting heat in the combination.

THE PHYSICAL APPEARANCE OF THE SUN

in the telescope is like a mass of clouds, or rather curdled milk or cotton wool. It is much darker on the edges, which is a very important point in explaining its constitution, and there are also numerous bright streaks, called faculæ, besides the solar spots. Mr. Nasmyth thinks that these irregular forms resemble willow leaves. I have not seen that, but I have seen in the sun what seemed irregular masses, dark spaces, and here and there apparently little holes.

The bright spots, called faculæ, are elevations on the solar surface. But the most remarkable objects on the surface of the sun are the spots; they are far more striking than the faculæ, and this before you (pointing to the diagram) may be taken as a good example or type of such spot, fairly formed and well established. In the center of it is a dark spot looking like a hole. The holes are not usually uniformly dark; there are usually little bays formed in the surrounding region; the edges of these are sharply defined, with no shading. Around this center, called the umbra, there is a wide border called the penumbra, almost invariably darker toward its outside edge, and striped radially. This hole—the umbra, if it be a hole—is so large that the earth might be dropped through into it without touching its edge. It is over 12,000 miles in diameter. The faculæ are always very numerous near the spot. Where the faculæ comes to the edge, there is a little projection. As to the nature of the

SUN SPOTS,

it is absolutely certain that the dark centers are depressed below the solar surface, but whether they are holes through to the body of the sun is another question, but they are cavities when the spot is first formed. You do not see the umbra, but the penumbra. To talk of temperate zones in a body as hot as the sun seems strange, but the spots are found in the temperate zones. They are not common in the sun's equator, or more than 30° from the equator. Rare examples have been found at 40° or 45° from it.

VARIATIONS OF SUN SPOTS.

The most curious thing about them is that they are not equally frequent in different years, and are regular in their irregularity or periodicity. After appearing in great force, they become infrequent for three years; then they gradually increase in number until, in about ten years from the first period or maximum frequency, they are again abundant. Sometimes as many as 400 or 500 separate groups of spots have been remarked upon the sun in a single year, and again there is a year when spots are few, and there may not be more than 80 or 100 in a year; so that in the year of maximum spot-frequency, the number is four times as great as on the year of minimum frequency. The cause of this is not yet known, but it is surmised that it is connected with the motions of Mercury, Venus and Jupiter, though it is probably due to a periodical boiling over of the vast caldron. When we examine the sun with the spectroscope, we find outward motion. Under the cloudy surface there is an ocean of liquid, and slags are formed in this ocean, and there is a blowing out of matter which gives rise to the penumbral phenomenon. There is undoubtedly an underfeed from the outside toward the center, but whether by a rush downward from the center of the spot, I cannot say. The English astronomers believe it is from the outside atmosphere to the center of the spot.

Professor Young then proceeded to explain and illustrate by diagrams on the screen, the solar prominences and their spectra. Fig. 3 is a representation of the sun with chromosphere and prominences, showing the relative magnitudes of the latter as compared with the sun, and also their number. The inner circular line is the boundary of the sun proper as distinguished from the chromosphere. The remainder of the lecture was devoted to the description of eclipses and the lecturer's observation of phenomena, the details of which have already appeared in our columns.

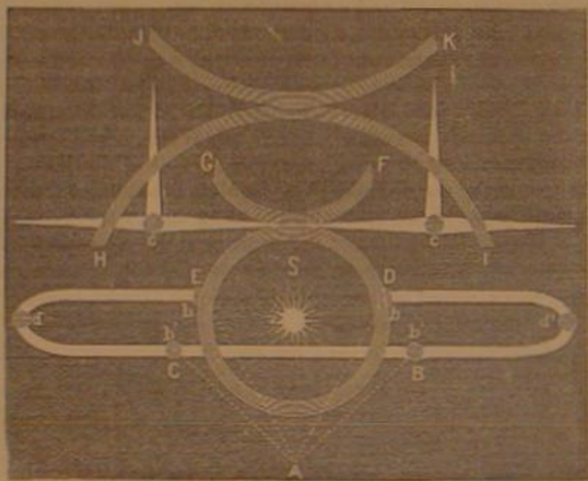
Correspondence.

Extraordinary Parhelia observed at Independence, Mo.

To the Editor of the Scientific American:

The inclosed diagram represents phenomena that occurred here on Saturday, January 25, at 9 o'clock A. M. In order that it may be better understood and more highly appreciated, it will be necessary to give some few points of description.

A is the place of observation; S the sun, E D a circle around the sun, or rainbow; F G is what we term the first reverse circle or rainbow; H I is a second circle or rainbow, whose brilliancy is cut short by the bright silvery belt, D B C E, which extends the whole heavens around, from east to west, in a plane, the hight of the sun, and parallel to the plane of the horizon, having its origin in the two dazzlingly brilliant sun dogs, or false suns, *b b*; J K is the second reverse rainbow, which was the most brilliant of all. The observations A B and A C, are west, and point to two very bright sun dogs, *b' b'*, which seem to correspond to D E in the east. *d* and *d'* are in the north and south, and quite bright also. But what is more singular, two more are at *c c*,



but they are much the same as the others, except *b b*, in color, being bright and silvery; and emanating from each, at right angles, are the silvery bright streaks shown in the figure, which neither absorb nor are absorbed by the semicircle, H I, but cross and produce the remarkably beautiful figure as seen in the misty clouds that morning. J K is a remarkably brilliant rainbow. E G is not so brilliant in the rainbow as J K, but is made dazzlingly bright at the point of contact with E D, by the two streaks from *c c*. Part of the circle, E D, is very brilliant, and H I is nearly as distinct, if not more so. The two sun dogs, *b b*, were fiery red around the edges, and some colors of the bow attend, which made them dazzlingly brilliant. One very singular thing about it was the appearance of the entire upper part of the figure in a plane, horizontal to D B C E, instead of in a vertical one, as is usually seen in rainbows. The background for the streaks proceeding from *c c* was a dark hazy blue, somewhat deeper than a sky blue.

The segment of the arc, J K, was apparently 90°; that of H I, 125°. Radius of H I seemed about 1,000 feet; J K, 750 feet; F G, 375 feet, and E D, 500 feet. The citizens here desire you to give or explain the philosophy of every part of the whole thing, either through your columns or by private letters. As we think it would be a very interesting matter to many of your readers, we hope you will insert the diagram and an explanation in your valuable paper.

The sky was, generally, slightly cloudy, hazy, and misty, and the earth was, and had been for some time, deeply covered with snow.

Will you please explain, particularly, the reversion of these rainbows? Some parts we understand, but what we want is an explanation of the whole thing as it was seen. The extreme upper part of the figure was east of a vertical line, and the whole was northwest of the sun's position.

D. M. Woodson.

Independence, Mo.

Remarks by the Editor.—When the sun is seen in a clear sky, the luminous disk is visible to us without any attendant phenomena; but if the air is loaded with moisture, or there are other favorable conditions, a great variety of phenomena present themselves and become the subject of investigation and study. The name halo is given indiscriminately to the circles which appear around the sun and the moon, and, for the purposes of precision, it has been proposed to call the rings about the sun "parhelia," and those about the moon, "paraselenæ." The parhelia witnessed at Independence were of rare occurrence, and we can only give the explanation of the phenomena that has been propounded by Newton and accepted by other philosophers. In cold weather, when particles of ice are floating in the higher regions, the sun is sometimes surrounded with the most complicated rings, circles, and mock suns, formed at the points where these circles intersect each other. Sir Isaac Newton considered the rings as produced by the light passing through very small drops of water, in the same manner as colors are produced by thin plates. Descartes supposed that the halos were due to refraction, through crystals of ice and snow floating in the air. The same view was taken by Mariotte, Young, Cavendish, and Brewster. In order to explain the larger halo, Dr. Young supposes that the rays which have been once refracted by the ice prisms fall on other prisms, and the effect is doubled by a second refraction, so as to produce a deviation of 90°. This explanation is not accepted by Brewster, who thinks that the external halo may be produced by the refraction of the rectangular terminations of crystals. All parties agree that such phenomena as were observed at Independence, Mo., are due to solid particles of ice floating in the higher regions of the air, and that refraction through ice prisms is the primitive cause. The air has been unusually charged with frozen water this winter, and an extraordinary number of halos, around the moon as well as around the sun, have been observed. On Lake Superior, the sun has been known to sink below the horizon and then to come up again to view, owing to a sudden change in the refracting medium through which the light passed. At Independence there was an unusual number of mock suns; but the other features of the parhelia were the same as have been pictured and described in works on natural philosophy. In fact, our correspondent will find in Brewster's "Treatise on Optics," two diagrams, one of parhelia and the other of paraselenæ, witnessed in 1630, which coincide very closely with the drawing shown by our engraving. The explanation of the whole set of phenomena is, therefore, resolvable into this, that the light was doubly refracted by ice prisms floating in the air, the sun being at a convenient hight above the horizon to produce the best effect. Experiments to prove the accuracy of this theory have been prepared and shown in the lecture rooms of professors of physics; and until a better explanation is offered, we prefer to abide by the above decision.

A Brilliant Meteor in Massachusetts.

To the Editor of the Scientific American:

I notice in your journal mention of meteors seen in Mason City, Ill., and in England, and the perusal calls to my mind a very sharp flash seen on the evening of January 11, 1873. It was caused by a large ball of fire, about the size of a bushel basket; it fell in Tyngsboro', Mass., some 6 or 7 miles from Lowell, on the Boston, Lowell, and Nashua Railroad. The flash was seen some twenty-five miles all around, and a dull rumbling sound was heard. It fell near or upon the railroad track, just in advance of an approaching passenger train, and caused quite a panic among the passengers, for a short time, until the conductor could satisfy them that there was no danger in proceeding.

W. H. R.

Lowell, Mass.

Tree Transplantation.

To the Editor of the Scientific American:

On page 37 of your current volume some one says: "Most persons make a fatal mistake in trimming trees when transplanted. Never cut off a limb or a twig till they (the trees) have a secure foothold."

This advice, in the Scientific American, at once becomes a powerful influence. Whatever affects the tree-planting interest is of national importance; and I think I can show by reasons sufficient, as I could by the experience of all successful tree planters, that the advice referred to is radically wrong, and should read: "Always cut down the top of a tree transplanted, so that the relative proportion be preserved between roots and branches."

A tree to secure a foothold in its new bed must make a new growth of wood both at the top and root; otherwise death results in all cases after transplantation. Most trees lose, in transplanting, the larger portion of their roots; how does this operate when the top is left of full size and untrimmed? The leaves come out full with the advent of spring; and it takes all the nourishment supplied by the remaining roots to support the leaves, and no new wood is made.

If the top of the tree is cut down and the leaf buds destroyed, then, of necessity, in order to put forth leaves, there must be a new woody growth; when this occurs, there is always a corresponding root growth, and thus a foothold is secured. Many trees, like the sugar maple, only make wood during a brief period in spring; consequently, if transplanted with ever so much care after this season, they invariably die.

A tree which continues making wood during the entire season, like the willow and locust, can with care be transplanted at any time; but it may be set down as a rule, with but few exceptions, that deciduous trees should only be transplanted when bare of leaves, and then the top left must be proportioned to the root.

To further illustrate the fallacy of the no trimming theory, suppose that in putting out cuttings, as of the cotton wood or willow, a top was left. Does any one suppose that a new root would be formed? It is the growth of the new top that is accompanied by new root growth; in fact they are inseparable. The everywhere popular white elm and sugar maple, although exceedingly difficult to transplant successfully with large tops, will generally live and grow if every branch is cut off and the short bare poles only set.

E. H. R.

A Spider Balloon.

To the Editor of the Scientific American:

If a description of a spider balloon will be of any interest to your readers, I will endeavor to give you particulars of one that I saw on the 10th of last October. It was a very calm and pleasant day, and not a breeze disturbed the still waters of Lake Seneca. In company with others I was crossing the lake, and when near the center one of the party noticed and called our attention to a small wake, caused by the moving of some insects; and with some difficulty we succeeded in gaining a point where we could see that they were spiders, three in number, gliding at a rapid rate over the smooth surface of the water; and we were much surprised to see a single thread, the size of a knitting needle, extending in the air to the hight of thirty feet, at an angle of sixty degrees, terminating with an enormous balloon-shaped web. I should think that it was eight feet long and five feet wide, with stays fastened to the main thread, something similar to those of a balloon; and it was managed, apparently, by an innumerable number of these insects stationed at proper intervals. Wishing to obtain a closer view, we undertook to approach it; but when we were within a few feet, it began to rise, though the last spider, which proved to be about the size of a house fly, was brought back by the stroke of an oar. The balloon went onward and upward until it was lost to sight. Whether this is a mode of travel peculiar to spiders, and how the balloon is kept in its proper shape, I am at a loss to know; and I should be glad to have an opinion.

Rock Stream, N. Y. C. F. HATHAWAY.

Heating of Journals.

To the Editor of the Scientific American:

I take great interest in reading the various articles in your paper, especially under the head of "Answers to Correspondents." I have watched the discussion lately in regard to running and standing balance, and last week I was called to look at an engine which was heating in the journals of the main shaft to such an extent that water had to be used to cool them off. I found the fly wheel about $\frac{1}{8}$ of an inch out of truth edgeways, the key being imperfectly fitted. The shaft was about 7 feet long and 5 inches in diameter, and the wheel, 10 feet in diameter. After properly fitting the key and trueing the wheel, I found the tendency of the shaft to "wobble" had disappeared; and after a few days of careful usage, the engine ran quietly and the bearings were cool.

C. C. C.

Spinning Cotton in the South.

To the Editor of the Scientific American:

In your issue of January 25, a correspondent from Aiken, S. C., mentions the necessity for a machine to spin cotton, that can be operated by the same power which gins the cotton in the Southern States.

This reminds me that, about thirty-five years since, some one introduced in this section a machine worked by hand, which ginned the cotton and spun it into yarns. These machines were usually placed in the hands of slaves and soon became worthless. Now is it not possible that some scientific mechanic might so enlarge and improve this machine as to make it available for the purpose suggested?

Warthen's Store, Ga. JOHN H. WALKER.

Powder versus Dynamite.

The explosive power of dynamite as compared to that of blasting powder is $2\frac{2}{3}$ to 1, that is to say, the same quantity of dynamite will do $2\frac{2}{3}$ times the work of powder. At the calamine mines of Chrzanow, the working effect of each hewer, driving in hard dolomite rock, is in an eight hours shift 6·5 cubic feet with dynamite against 3·5 to 4 cubic feet with powder, and when using the former each man can bore and fire three holes of 16 inches against two with powder. The explosion of dynamite is very sudden, and the rock is far more shattered by it, without being projected, as is the case with powder. At the tin mines of Graupen, in Bohemia, dynamite only shows a decided advantage when deep bore holes can be used, but it is unquestionable that in water-bearing rocks, when a charge of dynamite has never failed when judiciously treated, it is considered as much safer than powder. When sinking a round shaft of 12 feet diameter at the Britannia colliery, near Mariaschein, in Bohemia, through a bed of very hard and tough clay, another explosive, "haloxyline," was employed. Three holes of 30 to 40 inches were bored in the bottom of the shaft, and inclined to the sides of the shaft with an angle of 60°. They were charged each with 3·5 ounces of haloxyline, and fired simultaneously by electricity, when the whole mass of the rock, about 226 cubic feet, covering the area of the shaft, and to the depth of the holes, was so completely shattered that it could be easily removed.

A New Paper.

Iron, the Journal of Science, Metals and Manufactures, is the name of a new first class weekly paper, of large size, which made its appearance in London, on the 1st of January. It is devoted chiefly to iron-producing interests and iron manufactures, including also other metals. The numbers before us give evidence of marked ability in the editorship of every department, and the paper promises to be a most valuable addition to the ranks of scientific and special journals.

AN old colored minister, in a sermon on hell, pictured it as a region of ice and snow, where the damned froze throughout eternity. When privately asked his purpose in representing Gehenna in this way, he said: "I don't dare to tell dem people nuffin else. Why, if I were to say dat hell was warm, some o' dem old rhumatic niggas would be wantin' to start down dar de bery fust frost!"

How to Search for Metals.

SEARCHING FOR GOLD.

The paying localities of gold deposits are the slopes of the Rocky and Alleghany Mountains. Gold need not be looked for in the anthracite and bituminous coal fields, nor in limestone rock. It is seldom found in the beds of rivers. The thing itself is the surest indication of its existence. If soil or sand is washed, and the particles of gold are not heavy enough to remain at the bottom, but float away, the bed will not pay.

Along streams rather high up among the mountains, and in the gravelly drift covering the slopes of the valley below, are the best prospects. Where the stream meets an obstacle in its path, or makes a bend, or has deep holes, there we may look for "pockets" of gold. Black or red sands are usually richest. Gold-bearing rock is a slate or granite abounding in rusty-looking quartz veins, the latter containing iron pyrites or cavities. Almost all iron pyrites and silver ores may be worked for gold. When the quartz veins are thin and numerous rather than massive, and lie near the surface, they are considered most profitable. Few veins can be worked with profit very far down. As traces of gold may be found almost everywhere, no one should indulge in speculation before calculating the percentage and the cost of extraction. Gold hunting, after all, is a lottery with more blanks than prizes.

The substances most frequently mistaken for gold are iron pyrites, copper pyrites, and mica. The precious metal is easily distinguished from these by its malleability (flattening under the hammer) and its great weight, sinking rapidly in water.

SEARCHING FOR SILVER.

This metal is usually found with lead ore and native copper. Slates and sandstones intersected by igneous rocks, as trap and porphyry, are good localities. Pure silver is often found in or near iron ores and the dark brown zinc blende. The Colorado silver lodes are porous at the surface and colored more or less red or green. Any rock suspected of containing silver should be powdered and dissolved in nitric acid. Pour off the liquid and add to it a solution of salt. If a white powder falls to the bottom, which, upon exposure, turns black, there is silver in it. Silver mines increase in value as in depth, whereas gold diminishes as we descend.

SEARCHING FOR COPPER.

The copper ores, after exposure, or after being dipped in vinegar, are almost invariably green on the surface. They are most abundant near trap dykes. The pyrites are generally found in lead mines, and in granite and clay slate. Copper very rarely occurs in the new formations, as along the Atlantic and Gulf borders, and in the Mississippi valley south of Cairo.

SEARCHING FOR LEAD.

Lead is seldom discovered in the surface soil. It is also in vain to look for it in the coal region and along the coast. It must be sought in steep hills, in limestone and slate rocks. A surface cut by frequent ravines, or covered by vegetation in lines, indicates mineral crevices. The galena from the slate is said to contain more silver than that from the limestone. The purest specimens of galena are poorest in silver; the small veins are richest in the more precious metal. A lead vein is thickest in limestone, thinner in sandstone, and thinnest in slate.

SEARCHING FOR IRON.

Any heavy mineral of a black, brown, red, or yellow color may be suspected to be iron. To prove it, dissolve some in oil of vitriol and pour in an infusion of nut gall or oak bark; if it turns black, iron is present. If a tun of rich magnetic ore costs more than $4 at the furnace, good hematite more than $3, and poor ores more than $1.50 or $2, they are too expensive to pay, unless iron is unusually high. Deep mining for iron is not profitable. Generally speaking, a bed of good iron ore, a foot thick, will repay the cost of stripping it of soil, etc., twelve feet thick. Red and yellow earths, called ochers, contain iron. Magnetic ore is easily found by a compass.—*Underground Treasures, by Professor James Orton.*

[Dental Cosmos.]

Treatment of Exposed Dental Pulps.

BY DR. C. E. FRANCIS.

If, by any unlucky turn of the excavator, a healthy pulp gets suddenly uncovered and wounded, there is no necessity for destroying its vitality. Proper care and gentle treatment will almost invariably save it. Indeed, we have but to prevent inflammation by keeping away irritating agents, and the pulp will soon heal by first intention and deposit a sufficient amount of calciferous matter to fill the breach, and thus protect itself. Now let us see how this may be accomplished. If the tooth is aching, apply just sufficient carbolic acid to allay the pain; then cover with a small cap of note paper, and carefully fill with a tolerably thick paste of oxychloride of zinc. This has been my method for several years, as has been repeatedly stated and published. I have found, however, that though protected in this manner, pulps would sometimes become irritated by the application of the zinc, thus endangering their vitality. Recently I have overcome this trouble, and now have little fear of such danger. After applying the carbolic acid, and carefully mopping out the excess with a bit of soft spunk, I cover one side of the paper cap with a solution of balsam of fir with chloroform, and place it gently over the wound. The chloroform quickly evaporates and leaves a smooth, glossy coating of soothing balsam, which perfectly protects the pulp and holds the paper snugly in its position. The coating cannot be permeated by the muriate of zinc, and consequently bids it defiance.

Having given reasons for using the balsam, let us consider the benefit derived from the use of the paper "cap." Cut from note paper, it is smooth and of just the thickness to be manageable, and is the best substance of the same bulk for protecting the pulp from thermal shocks that can be used.

As for the zinc, its office is purely mechanical. It simply makes a good, firm cover to the pulp, and a floor or foundation for a gold filling. Some individuals seem to imagine that oxychloride of zinc possesses some medicinal virtue that acts with magic influence upon an exposed pulp. No such thing! Despite its "antiseptic properties," it tends to irritate wherever applied, and endangers the vitality of any pulp that it touches.

Aerial Navigation.

M. Hannel, Ingénieur des Arts et Manufactures, lately presented to the French Aëronautical Society some observations upon the flight of birds, which are worth noticing. He assumes that, during normal flight, the speed of the center of movement of the wings is constant, and equals 1·15 meters or $3\frac{1}{2}$ feet per second. This center of movement is situated on the line which divides the triangle representing the wing in two equivalent parts. The weight which a bird can support without fatigue, may increase, according to circumstances, up to one half of its own weight; the mean value is equal to one fourth of its weight. The total load, that is to say, the weight of the bird, increased by the weight that it can carry, is thus, on an average, equal to five-fourths its proper weight. The relation between the total load and the breadth of wing is $x = y \log. 500$, or, $x = y^{2 \cdot 69897}$.

In this formula x represents the total load expressed in kilogrammes, and y the breadth of the wing in meters. A kilogramme is 2·2 lbs., and a meter is 1·1 yards nearly. This formula can be applied to insects as well as to birds.

Supposing this formula to hold good for all bodies passing through the air, and carrying with them their motive power, the application of it can be made to a man or a machine. For a machine weighing 3·5 tuns, the spread of wing should be 26 feet, and 6 yards for a man weighing, with the necessary appliances, 220 lbs.

The conclusions of M. Hannel have been discussed by a large number of the Society, who in the majority do not agree with them. They have been compared with those of M. Harting, according to whom the weight increases according to the cube of the lengths of the wings, modified by a coefficient which varies with different kinds of birds. M. Hannel and M. Harting do not consider the weight and spread of wings in the same manner, and they do not adopt the same speed. Besides, M. Hannel assumes a constant speed in the center of motion, an assumption which has not been proved mathematically.

Improvement in the Manufacture of Sulphuric Acid.

The platinum vessels employed for the concentration of sulphuric acid are extremely costly. A small portion of the platinum is moreover constantly dissolved, and represents a money loss of considerable importance. Manufacturers have, for these reasons, long sought for a less costly material to replace the platinum. In 1844 M. Kulhmann, of Lille, remarked that the temperature of boiling sulphuric acid at 66° Baume, when, instead of being subjected to atmospheric pressure, it was kept almost in vacuo, was reduced from 325° to 190 or 195°. Now lead is not attacked by the acid at a temperature below 200 or 205°.

M. de Heuiptume, a manufacturing chemist of Molenbeek-Saint-Jean-les-Bruxelles, has succeeded in establishing, on a commercial footing, a process of concentration in lead vessels and in vacuo.

The vacuum is made to the degree desired by the condensation of steam injected into a cast iron boiler in communication with the concentrating vessel.

According to the calculation of M. Heuiptume, the concentration of one bottle of sulphuric acid, weighing 220 lbs., costs 17·4 cents, if effected by the platinum process, and 9·46 cents if his vacuum method be adopted. The gain therefore, resulting from this latter system would be 7·94 cents per bottle, or 44 per cent.

The Purification of Rivers.

Mr. J. J. Lundy, of Edinburgh, Scotland, recently published a pamphlet on the above topic, in which he proposes a plan which will take, from foul water, impurities of every kind, whether of sewage or of manufacturers' and dyers' waste waters.

The substance used is a peculiar kind of animal charcoal made from any substance which is not bone. It is stated to be not only a powerful decolorizer but has peculiar powers of absorbing not only organic but also inorganic substances, while it is from twenty to fifty times cheaper than ordinary bone charcoal.

In carrying out the method proposed by the author, of using this material, the sewage is caused to fall into a bed of sand which lies on a thinner bed of gravel, under which lies a bed of the charcoal. After passing through another layer of gravel, the liquid goes upward through more charcoal and flows over into a bed of sand. It is thus thoroughly filtered and purified.

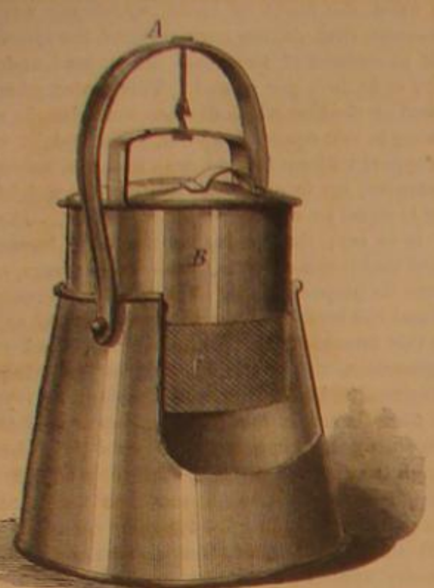
The charcoal after use may be laid aside in the open air without causing any smell, and in a little time will recover its original power, or it may be reburnt or distilled with great profit, as the whole of the nitrogen taken from the sewage would pass over in the distillation as ammonia, accompanied by other valuable products.

THE production of musical sounds from magnets, by Dr. Page, was effected in 1837.

CULINARY BOILER.

We leave the question to housekeepers generally whether, in all the varied routine of the kitchen, there is anything more extremely disagreeable—soul-trying we might say—than to elevate a heavy kettle from the range and pour off the water from its contents, thereby scalding one's fingers or, in an unguarded moment, dumping the cooked articles into the sink. With the presumption that the universal response will be that there is not, we present an illustration of an invention which, by the simplest possible method, does away with the whole difficulty.

Here is a large kettle having a curved bale, A. Within is a smaller vessel, B, having a cover and bale, the lower part of which, C, instead of being solid, is perforated. This inner kettle has a flange around its top so that it fits closely into and on the outer vessel.



Water is placed in the large kettle, and the thing to be cooked in the small one, which, of course, is tightly covered, and set down in place. Then, when the boiling is finished, the inside kettle is lifted by its bale and hung by a hook to a swivel attached to the bale of the outer vessel in the position shown in our engraving, and there it is left until its contents are properly drained or steamed.

Ruth Russell, of 132 Union street, New Bedford, Mass., is the lady to whom the credit of this excellent little invention is due, and from her further particulars may be obtained. Patented January 2, 1872.

Statue of Elias Howe, Jr.

The model for the statue of the inventor of the sewing machine, Elias Howe, which is to be placed in the Central Park in this city, is now complete. It is the design of Mr. Ellis. The work is eight feet in hight and the tall figure stands erect, the weight of the body resting on the left foot. In the right leg a certain stiffness is noticeable, and the knees are closer together than perfect proportion sanctions. These peculiarities, however, belonged to Mr. Howe's physique, and demand recognition in any honest portrait of him. The right hand holds a walking stick, the left a broad brimmed hat. The costume is simply a reproduction of that of the ordinary man of business in the upper walks of life. The long and many-ringleted hair, which constituted so impressive a *chevelure*, is exceedingly well rendered, and the countenance expresses that intrepidity, obstinacy, patience, honesty and hope which sustained the inventor of the sewing machine through the quarter of a century through which he toiled to obtain permanent success. The statue is to be cast in bronze in Philadelphia, and is to be ready in May next. Three bas-reliefs are to adorn the pedestal. One of these is to illustrate the misery of the pre-sewing machine needlewoman, as indicated in Hood's "Song of the Shirt." The second will show Elias Howe, Jr., in his workshop pondering over his first machine. The third will indicate the perfected instrument under the easy manipulation of the average worker. These bas-reliefs will adorn three sides of the pedestal. An inscription will probably find place on the fourth.

Magnetic Iron.

Magnetic iron ore, or "magnetite," received its name in early times from its magnetic properties. A mass of the ore influences the needle at a great distance. The magnetism of the ore is polar, the same side which repels one end of the needle attracting the other, and *vice versâ* with the other side. It crystalizes in the cubical system, the octahedron and rhombic dodecahedron being common forms. It occurs in Sweden, Norway, the Ural Mountains, etc., and on a very much smaller scale in England. In the southeast corner of Dartmoor, a band of this kind of ore deranges a compass as it is carried past its vicinity, and sailors say that there is a place in Cardigan Bay where, on passing a reef of rocks, the needle is influenced, and set oscillating. A large mass of this deposit in the southeast extremity of the Island of Elba has a similar effect; in Sweden, too, deposits are discovered by means of this property. Meteorites frequently contain a percentage of iron greater than magnetite, associated with nickel and chrysolite in some cases; but the rarity of their occurrence precludes them from being classed as iron ores, by which term we understand a mineral containing iron in sufficient quantity to be economically and advantageously extracted.

OSCILLATING PUMP.

The accompanying engravings represent a new form of oscillating pump, the novelty of which consists in the use of a section of a hollow cylinder, oscillating on its longitudinal axis, in connection with a stationary packing and suitably arranged valves. By this construction it is claimed that increased efficiency of working parts is obtained, and that the usual boring out and much of the necessary fitting, incident to pumps of this class, are dispensed with.

Fig. 1

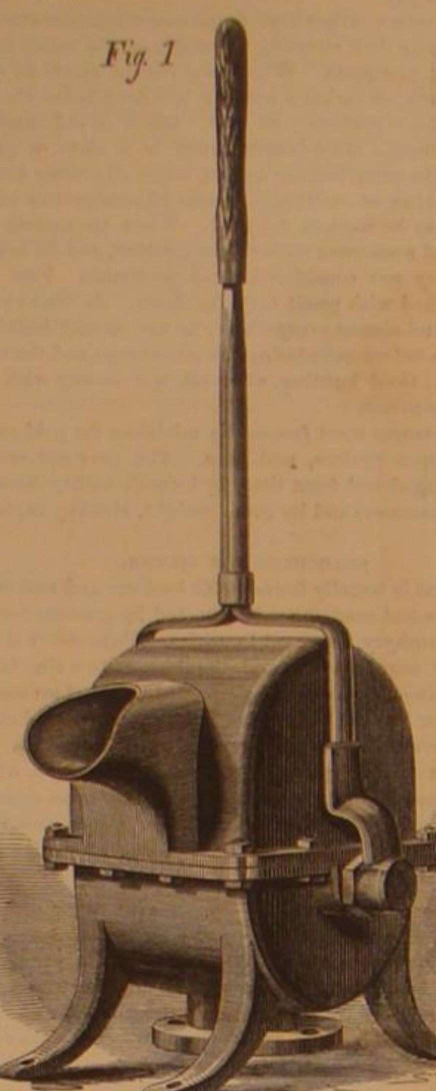
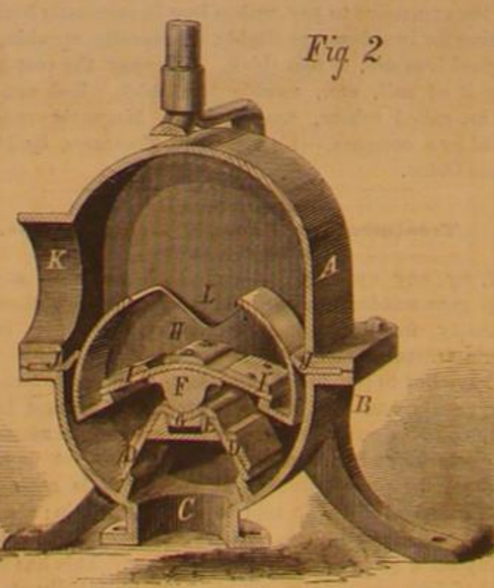


Fig. 1 affords a perspective view of the device, and Fig. 2, a representation of the interior portions. A and B are the two sections of the shell or outer casing, each provided with a flange and bolted together to form an oblong cylinder with closed ends. C is the induction chamber, in which are valves opening upwards. The leather forming these valves is in one piece, passing over the abutment, E, thereby packing the joint between it and the shaft, F. G is a plate supported on springs in a groove in the abutment and serves to hold the leather in close contact with the shaft. H is a sectional hollow cylinder connected to the shaft, F, by plates through which are ports, closed by the valves, I I, opening upwards.

The joint between the sections, A and B, is packed with leather, the inner edges of which are turned up as shown at J J, and, resting against the periphery of the cylinder, H, serve also as packing between said cylinder and the casing.

Fig 2



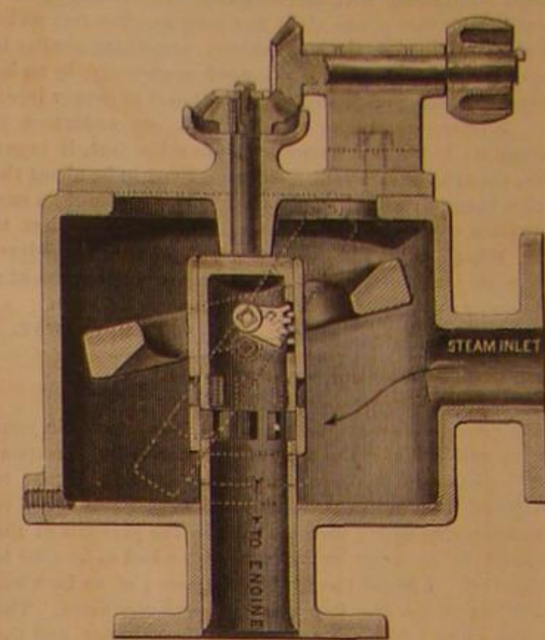
K is the discharge opening leading from the air chamber formed by the upper portion of the section, A. The outer ends of the shaft, F, are squared to receive a handle, as shown, by which the cylinder, H, is caused to oscillate in its bearings. By this means, through the action of the valves, I I, the water is drawn into the interior of the cylinder, whence it passes through the opening, L, and finally escapes from the discharge, K.

The invention, as is evident from the illustration, is very simple in construction. The cylinder, H, is turned off with great facility, and as the two sections of the case are cast separately, each in a single piece, little is required beyond attaching the lower valves and bolting the flanges together. By removing the top section, the entire working parts are exposed for examination and repair.

Patented November 12, 1872. For further information address Messrs. Murrill & Keizer, machinists, No. 44 Holliday street, Baltimore, Md.

NEW GYROSCOPE GOVERNOR.

The accompanying plan of a recently invented gyroscopic governor, which we find in *Engineering*, is simple in form and very sensitive in action. The device is contained in a casing in which the steam from the boiler enters, as shown. Motion is obtained from the bevel gearing, the horizontal wheel of which is keyed to a spindle which passes through the top of the case. This spindle is made in a single piece with the tubular portion represented as extending down into the pipe through which the steam passes. The upper end of this tu-



bular casting is closed, and being caused to fit tightly, by the pressure of the steam, against the lower extremity of the socket through which the spindle enters the casing, a steam-tight joint is obtained without employing a stuffing box.

A brass sleeve, sliding freely on the tubular casting has formed in it a number of ports which, when the sleeve is in a certain position, correspond to similar orifices in the casting. When the two sets of ports correspond, the steam has clear passage to the engine, but as the sleeve is raised the apertures are more or less closed until the steam way is shut off altogether. Upon a spindle which passes transversely through the sleeve and casting, is mounted a heavy "flyer," of the form shown in the cut. The spindle is attached to the sleeve and rises and falls with it, oblong holes being made in the casting to allow of such motion. At the center of the spindle is a quadrant which gears in a rack inside the tubular casting.

Suppose the various parts to be in the position indicated by the dotted lines, and the steam way full open. When the governor is set in motion, the flyer will become nearly horizontal, and in assuming such position will cause the spindle and its quadrant to partially rotate. The effect is to cause the latter to climb up the rack, lifting with it the spindle and consequently the flyer and sleeve. This motion, of course, closes the steam ports to a greater or less degree. It will be seen that the principle of the device is to oppose the constant weight of the flyer and sliding sleeve to the centrifugal force.

British Iron Manufacture in 1872.

According to *Iron*, the most noteworthy events connected with the British iron manufacture, for 1872, were the practical introduction in England of two American inventions by which the business is being rapidly revolutionized. We allude to the Rotating Puddling Furnace of Samuel Danks, of Cincinnati, Ohio, and the Chemical Puddling process of James Henderson, of New York city.

The latter consists in treating the molten iron with fluorine, by which all impurities are quickly eliminated. The common cinder ore, which the ironmasters in this country have heretofore been accustomed to haul out at much expense and throw away, will, when remelted and Hendersonized, yield fifty-five per cent of the very finest quality of iron. The great masses of this refuse, which surround the vicinity of nearly all iron works, are, by this new process, converted into deposits of precious value. One establishment in this country is said to have enough of this refuse at its doors to yield a profit of six millions of dollars over all expenses of re-working. The Henderson process produces pure iron, no matter what may be the impurities of the pig, whether phosphorus, sulphur, manganese, carbon or silicium. Even from iron pyrites the process brings out pure metal.

Ebony wood weighs eighty-three pounds to the cubic foot; *lignum vitæ*, the same; hickory, fifty-two pounds; birch, forty-five pounds; beech, forty; yellow pine, thirty-eight; white pine, twenty-five; cork, fifteen; and water, sixty-two.

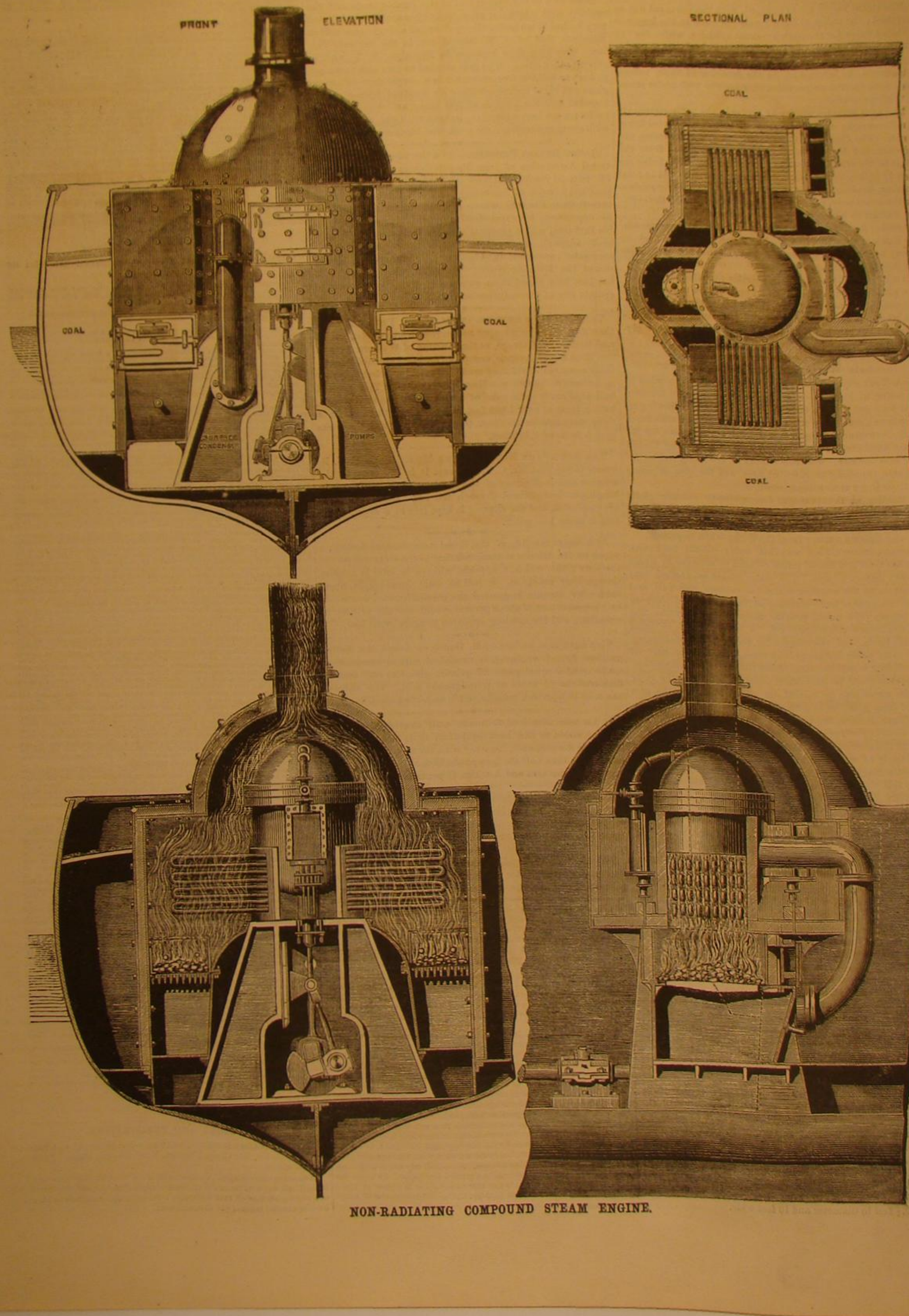
The Managers of the Nashville Industrial Exposition announce their third annual display, to take place during the whole of the month of May, 1873. Buildings have been erected specially for this exhibition, and the departments have been increased in number and extended in range. For further information, see our advertising columns.

NON-RADIATING STEAM ENGINE.

The illustrations which we herewith give have been prepared for the inventors, Messrs. Moy & Shilly, by Mr. N. P. Burgh, and show the machinery as fitted in a 17 tun yacht. We wish it to be understood, says *The Engineer*, from which we quote, that for the present we *prefer* to reserve all expression of opinion as to the merit of the invention other than is contained in the statement that the principle adopted by the inventors is apparently consistent with the conditions essential to obtaining high economy of fuel. The difficulties which the inventors will have to contend with lie in devising such a mode of construction as will prevent the engine from being destroyed by the high temperature and excessive dryness of the fluid by which it is worked, which fluid is essentially what has been well termed, by the late Professor Rankine, "steam gas," which is a very different thing from ordinary saturated steam.

It will be seen that the engine *proper* is constructed on the compound principle, with two cylinders. These, with a portion of the boiler, are made in one casting. The heating surface is supplied by a number of horizontal ⊃ tubes projecting from that portion of the boiler which surrounds the cylinders. The boiler and cylinders are together included within an iron casing lined with fire brick, which also includes the furnace, as will be readily understood from a glance at our engraving, and the course taken by the products of combustion, will be easily comprehended. By thus putting the cylinders in the boiler, and the whole boiler in the furnace, radiation of heat is of course practically prevented, and for this reason the title of non-radiating engine has been selected by the inventors.

The engine we illustrate is nominally 10 horse power, but it is anticipated that the efficiency of the steam will be so



NON-RADIATING COMPOUND STEAM ENGINE.

great that it can be worked up to 100 indicated horse power.

The high pressure cylinder is 6 inches in diameter, and the low pressure cylinder 15 inches in diameter, the stroke of the pistons being 12 inches, and their depths or thickness 6 inches, because the lowest working pressure of the steam is 200 lbs. on the square inch, and the highest pressure, 400 lbs. on the square inch in the small cylinder. It will be noticed that the pistons have no rings or springs, but grooves are formed in them to keep them tight on a well known principle. [Patented by Wm. S. Gale, of New York city, July 21, 1857.] The cylinders have wrought iron liners for the purpose of renewal and strength.

The steam valves are cylindrical, with the ports cut out as required; the steam or cut-off valve is fitted in the larger or exhaust valve for the high pressure cylinder, while, for the low pressure engine, two single cylindrical valves are used—half cut in two for the exhaust. Mr. Burgh has had some experience, he informs us, in the working of those valves, and, with careful proportions, they answer well under steam of high pressure.

The next features worthy of notice in the arrangement are the dimensions over all, in proportion to the indicated horse power. The diameter of the boiler or casing inclosing the cylinders is 2 feet 5½ inches, and the total depth from the dome to the stuffing boxes is 3 feet 3 inches. The tubes are each 1⅛ inches outside diameter, 2 feet long, and 144 in total number, making an area of 122 square feet heating surface for the tubes only, to say nothing of the surface of the cylinder casing, to which the tubes are secured.

Another matter the inventors claim is that, in large vessels, the stoking, with inverted engines, is on the second deck, or it may be often on the weather deck, so that hot stokeholes low down in a ship are eliminated.

It will probably be found in practice that the heating surface provided is too small; but let opinions on the subject of proportion be what they may, it is certain that the scheme, as a whole, is sufficiently novel and promising in numerous respects to entitle it to the prominence which we have given to it.

Salt Water for New York City.

New York city, it is well known, is almost surrounded by salt water, as it occupies a tongue of land, some fourteen miles long and about a mile broad, the sea water flowing up along both sides. The city is at present supplied with fresh water, for extinguishing fires and all other purposes, by the Croton Aqueduct, 42 miles long, which conducts the Croton river into the city. But this supply is becoming rather inadequate, especially in cases of fires, and the idea of using the river water is now being studied.

A meeting of the municipal Committee to consider plans on this subject, was lately held. One proposition was to provide a series of floating fire engines to patrol around the city, and throw up water from the docks when required.

Thomas Miller's plan was that water should be drawn from the river and forced into a column or receiver by a pair of heavy duplex pumps. The water would be carried into the sewers by the overflow when the column was full, and when the pumps were working at full speed the thirteen inch supply pipe would provide more water than the 22½ inch fire nozzle could draw off. A house would be built around the base of the column for the purpose of keeping hose carts ready for use at any time. The upper part of the building would be reserved for the use of the employees. The streets could be excavated, pipes be laid from the river and the whole plan be carried out within eight months, at a cost of from $160,000 to $180,000.

William Nelson, Jr., proposed that pipes should be laid from river to river every ten streets below Fourteenth street, beneath the surface of the river, so that there would always be a supply of water. The cost would be about $10 a foot.

Captain Hugh McKay submitted a plan whereby salt water, as the tide ebbs and flows, may be forced into towers or reservoirs, placed on the wharves.

A Simple Method of Warming Greenhouses.

The London *Grocer* suggests that greenhouses, containing half-hardy plants and in which no regular method of heating exists, may be warmed even during a hard frost by lighting and distributing a dozen or so common oil lamps, at convenient localities. In selecting these lamps they should be chosen with vases large in proportion to the size of the flat wick, in order that they may continue burning all night without refilling or other attention. It will be readily understood that, whether one or many lamps are used, the total amount of heat given off is proportionate to the quantity of oil burned, provided the combustion is complete. And in using a lamp, all the heat of combustion is utilized; none goes up the flue as with stoves or fire places.

The same journal, we notice, refers to Pratt's Astral Oil as a very carefully and skilfully refined petroleum product. As this material, in addition to other advantages, possesses that of safety, it would be especially suitable for use as above described.

SWEDEN is taking her place among inventive nations. Some very ingenious and useful inventions have recently been sent to this country to be patented. During the past week we have filed in the Patent Office applications from two different parties, natives of Sweden, and have since received instructions to prepare a third case, the latter the invention of a Swedish lady, residing in Stockholm.

A LARGE WATER WHEEL.—A correspondent, R. H. D., reminds us that there is at Rockville, Conn., a breast water wheel 55½ feet in diameter and 10 feet wide.

Cheap Postage Coming.

We recently chronicled the passage of a law abolishing the franking privilege, as a result whereof a reduction of postage was expected. We are glad to say that the House of Representatives has recently passed a bill reducing the postage on all letters from three to two cents. We earnestly hope that the Senate will also pass the bill, so that it may become a law.

The bill also provides that newspapers shall be prepaid at the office where mailed.

The Way the Forests Go.

Some idea of the vast extent of the lumber trade and the rapidity with which our great forest trees are being consumed may be had if we notice the products of a single saw mill in Michigan, that of A. W. Sage & Co., in the Saginaw Valley. This firm does business in Brooklyn, N. Y., and in several other cities. The mill alluded to cuts and turns out as high as 370,000 feet of lumber in a single day. Five engines and eight boilers, yielding six hundred horses power, together with the services of 300 men, are required. The buildings are very extensive, lighted with gas, and supplied with every convenience for work that ingenuity can suggest.

DANKS' ROTARY PUDDLER.—At a late meeting of the National Association of Iron Manufacturers at Philadelphia, Mr. Samuel Danks addressed the members in regard to the practical benefits of his rotary puddler. He has lately returned from England, where, after encountering considerable opposition, he succeeded in introducing about fifty of his furnaces, with a prospect that his invention will be generally adopted. In the United States, these furnaces are in successful operation in Cincinnati, Chattanooga, Tenn., and at the Millville Works, Pittsburgh, where a new mill has just been added at an expense of $500,000, intended to contain five of these furnaces.

TEN THOUSAND REAPERS AND MOWERS A YEAR FROM ONE CONCERN.—The new reaper and mower works of McCormick and Brother, at Chicago, at the junction of Western Avenue and Blue Island Avenue, occupy an enclosed space of twenty-three acres. In 1847 they made 500 machines; but they now manufacture 10,000 machines per annum. The present buildings cover three sides of a square, are five stories high, have a front of over 1,000 feet in length, and there is also a three story middle building. On the lake and canal, the works have a front of 1,300 feet.

THE BAR AT THE MOUTH OF THE MISSISSIPPI.—E. K. R. writes to say that Mr. C. W. Stewart is in error as to the number and inefficiency of the dredge boats employed in keeping a clear channel through the bar. Only two boats are employed, and the channel is kept free to a depth of 17 feet at mean low water.

AT a recent meeting of the Royal Astronomical Society, a paper by Mr. Hind was read, relating to the solar eclipse of the year 2,151, which, it appears, will not be total in London though very nearly so. It will be total, however, in Sheffield. Mr. Dunkin suggested the possibility that no considerable proportion of those present would see the eclipse in question; and the meeting appeared to agree with him.

THE navigable balloon of M. Dupuy de Lome, the distinguished French engineer, is varnished with a composition made up of 3 equal parts of gelatin, glycerin, and tannin, dissolved in 12 parts of pyroligneous acid. The varnish has been on fourteen months and is in perfect condition.

IF the total length of railroads in all countries is 146,243 English miles, as has been computed, it is not surprising that their maintenance, together with the new construction, takes more than half the iron production of the world. Europe has 48 per cent and America 47 per cent of the whole.

NOT only will the repeal of the franking privilege save so much, directly, to the Department, but it will lead to the suppression of a large portion of Congressional printing, heretofore ordered by Congress.

THE Commissioner of Patents has granted a patent to George C. Campbell, for putting a mixture of corn meal and rye meal into a package, as a new article of manufacture.

PATENT OFFICE DECISIONS.

IMPROVEMENT IN BILLIARD TABLES.—COLLENDER VS. GRIFFITH.—INTERFERENCE.

If an application is filed for a mechanical patent for construction, and if a design for which a patent has been granted can be produced only by that construction, an interference should be declared between the application and the patent.

THACHER, *Acting Commissioner:*

This is an appeal from a decision of the Examiner dissolving the interference. The main reason for the dissolution is that an interference is improper between an application for a mechanical patent and a patent for a design.

The decision of the Examiner dissolving the interference is overruled.

IMPROVEMENT IN HARVESTERS.—CHAS. G. DICKINSON.—EXTENSION.

Where an assignee of a patent has had it reissued, and the inventor has accepted an assignment of one half of the reissued patent, he cannot have an extension of the original.

THACHER, *Acting Commissioner:*

In 1858 Dickinson assigned to J. R. Parsons all his right in the patent "and in all extensions and reissues of the same." In May, 1871, Parsons surrendered and reissued, the new patent being granted to him as assignee. *

To enable him to apply for an extension, applicant has obtained from Parsons a re-transfer of one half his interest in the invention. He petitions for the extension of the original patent, and bases his right to the same on the fact that the reissue was obtained without his knowledge and consent, and that he never has taken an interest therein. If this was the fact the application would be proper, and the prayer of petitioner, the testimony being sufficient, might be granted.

In the re-assignment to Dickinson, however, Parsons transfers to him "one undivided half part of my entire interest in said invention and letters patent issued therefor." Now, the only patent in which the assignor had an interest at the time of making the instrument was the reissue obtained by him, and it is evident, therefore, from the terms of the assignment, that by the transfer the assignee became invested with a one half interest in the reissued patent. Judge Blatchford, in *Potter vs. Braunsdorf*, 7 Blatchford, 97, where the extension of an old patent which had been reissued was declared valid, bases his decision upon the fact that the original patentee had never assented to the reissue or acquired any title thereunder. This is set forth so distinctly as to authorize the conclusion that the converse must be true—that is, if the inventor by any act of his own has adopted the reissue, or in any way assented thereto, the extension of the original patent would be invalid. The purchase by the original patentee of an interest in the reissued patent stamps the act of surrender and reissue with his approval; an assent in words could not be stronger.

I have come to the conclusion, therefore, that the extension of the original patent in this case would be invalid, and the prayer of the petitioner must consequently be denied.

DECISIONS OF THE COURTS.

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

THE LOCOMOTIVE ENGINE SAFETY TRUCK COMPANY VS. THE ERIE RAILWAY COMPANY.—PATENT OF A. F. SMITH, FEBRUARY 11, 1862, FOR TRUCKS FOR LOCOMOTIVES.

[In Equity.—Before Blatchford, Judge.—Decision December 30, 1872.]

BLATCHFORD, *Judge:*

This suit is founded on letters patent granted to Alba F. Smith, February 11, 1862, for an "improvement in trucks for locomotives." *

The claim is:

"The employment, in a locomotive engine, of a truck or pilot wheels, fitted with pendent links to allow of lateral motion to the engine, as specified, whereby the drivers of said engine are allowed to remain correctly on the track, in consequence of the lateral motion of the truck allowed for by said pendent links, when running on a curve, as set forth." *

The issue is as to the novelty of the invention. I order to determine this question, it is necessary to clearly see what invention is claimed in Smith's patent.

He does not claim laterally moving trucks—that is, trucks with laterally swinging bolsters. Nor does he claim pendent links, by themselves. Laterally moving trucks applied to railroad cars which had at each end one of such trucks, free also to swivel around a king bolt which connected the car to the truck and passed through the center of the swinging bolster, which was the center of the truck, were old. The specification so admits. But Smith's invention, as claimed, is for the use in, and the combination with, a locomotive engine—that is, a structure having at its rear end, not a swiveling truck, but non-swiveling driving wheels, with axles rigidly attached to the body of the engine—of a swiveling pilot or leading truck, provided with pendent links to allow the forward part of the engine to move laterally over the truck when the truck and the driving wheels are not together in a straight track, whereby the forward part of the engine can move onward in a line tangent to a curve, while the axles of the driving wheels are parallel, or nearly so, to the radial line of the curve, and the axles of the truck wheels also become parallel to the radial line of the curve, because the truck is made to swivel around the king bolt by the action of the rails on the flanges of the truck wheels. *

The patent granted to Bridges and Davenport, May 4, 1841, for an "improvement in railway carriages," shows a swinging bolster in a truck swiveling on a king bolt, the body of the car being connected to the truck frame by pendulous links, from which such body is hung, whereby a lateral motion of the truck is permitted, independently of the body of the car, the sidewise motion being checked by springs in the truck. But the specification of that patent does not suggest the use of such truck in any other structure than a car having one of such trucks at each end and two king bolts. Nor did it, or the use of two of such swinging bolsters in a car, suggest, from 1842 to 1862, the combination of such a swinging bolster truck with a locomotive engine, for the purpose set forth in Smith's specification. *

The only other pre-existing invention brought up to affect the novelty of the Smith invention is the patent granted to Levi Bissell, August 4, 1857, for an "improvement in trucks for locomotives." Bissell's truck is shown under the forward part of a locomotive engine. It has a provision designed to allow a lateral motion of the truck independently of the motion of the body of the engine, and a provision to cause the forward part of the engine to mount up an incline toward the outer side, in a curve, and thus check the sidewise movement, and to descend by its gravity to the normal position on resuming the straight track. The specification of Bissell's patent says that the object of his invention is "to retain the truck with the axles always at right angles to the rail, whether on a straight or curved track, and prevent the truck swinging around on its center pin in case of meeting with any obstruction, and to make the curvature of the rail the means for turning the truck, so that the axles are parallel to the radial line of the given curve, in which position they are retained firmly until the direction of the track again changes." The specification then points out the difficulties in the use of locomotive engines on curves with the ordinary pilot truck, resulting in a "constant sidewise sliding motion on the rail," in consequence of the driving wheels being forced in a line deflected from that of a cylindrical forward rolling motion, and in a constant bearing of the truck to the outer side of the curve, and in the tendency of the engine to go off the track, "particularly in case a broken rail or obstruction occurs, when the truck swivels around on its center pin." *

It is apparent that the truck in Bissell's locomotive has no swiveling motion around its center pin or king bolt—that is, around the center pin in the center of the truck which connects the truck with the engine. Bissell expressly states that such center pin loses its character as a center of motion, and becomes simply a draft block or pin, and that the center of motion of the truck—that is, its only center of motion—is thrown back to the point h outside of the truck. *

In the engine of Smith the truck wheels and the drivers can at all times when the engine is on a curve, and when it is leaving a curve, and when is passing from a curve in one direction to a curve in another direction take their proper positions, respectively, without either being controlled or interfered with by the other. The reason for this is that the truck in the Smith engine has a swiveling motion on its king bolt, and also admits of the swinging motion across the track of the engine over the truck or the truck under the engine. Neither of these motions affects the other. If either motion interfered with the other the same result would follow as in Bissell's engine, and the position of the drivers would at times control the position of the axles of the truck wheels. But with Smith's arrangement the track alone controls the position of the axles of the truck wheels, and therefore they assume their correct position on any track, straight or curved, and on any form of curve, and whether the drivers are on a straight track with the truck wheels, or on the same curve with the truck wheels, or on a straight track while the truck wheels are on a curve, or on a curve while the truck wheels are on a straight track, or on one curve while the truck wheels are on a different curve. This is a result not attained in Bissell's engine, and it results from the fact that the arrangements and modes of operation of the two structures are different. The truck wheels in Smith's engine are never twisted on the track, and the direction of the longitudinal center line of the engine does not affect the position of their axles.

It results from these considerations that, in the engine as a whole, the Smith arrangement of truck is not merely an equivalent for the Bissell arrangement of truck, because, when the former is substituted for the latter, the resulting structure has a different mode of operation, and produces results which the other structure cannot produce. The thing to be looked at is the combined and mutual action of the drivers and the truck wheels, for that was the problem which both Bissell and Smith were trying to solve. Smith's claim is substantially a claim to the combination, with the drivers, of a truck arranged as he describes, allowing of the lateral motion described, and securing the proper position of the drivers on the track on curves. That combination is not found in Bissell's engine.

It needs no argument to show, in view of the foregoing considerations, that there was a patentable novelty in the combination which Smith made in his engine, although the truck which he employed existed before, as the Kipple and Bullock truck. The combination produces a new mode of operation and new results in the structure as a whole, although the truck, as respects itself, in swiveling and in having a lateral movement operates in the same way it did in the car which had two of such trucks. *

Decree with costs to the plaintiffs.

Keller & Blake, for complainant.

C. A. Seward, for defendant.

NEW BOOKS AND PUBLICATIONS.

THE YALE NAUGHT-ICAL ALMANAC FOR 1873. C. C. Chatfield & Co, 460 Chapel Street, New Haven, Conn. Price 35 cents.

An amusing little pamphlet, something after the "Josh Billings' Alliminax style, illustrated with humorous sketches of student life at Yale. Graduates and undergraduates of that venerable institution will doubtless find the book of especial interest and entertainment.

Recent American and Foreign Patents.

Condensed Milk Can Holder.

Robert J. Tanner, Lake View, N. J.—This invention consists of a new article of manufacture, which is a mug or cup adapted to hold the small tin cans of condensed milk used on the table, the object being to provide means for using the said milk cans on the table without exposing their unsightliness, it having a neat external finish.

Improved Cotton Seed Planter.

Francis E. Habersham, Old Church, Va.—This invention has for its object to furnish an improved machine for planting cotton seed. The frame of the machine consists of two long side bars connected near their ends by two short cross bars. The axle revolves in bearings attached to the side bars, to the ends of which are attached the wheels so as to carry the said axle with them in their revolution. The seed hopper is placed just in front of the axle and is hinged at its forward side to the frame by suitable means. The hopper is held in position by a spring, the elasticity of which allows the hopper to be shaken to shake down the seed. To the center of the axle is secured a plate with three or more arms. Upon the outer ends of the arms of the plate are formed saw teeth. As the machine is drawn forward the armed plate is revolved,and as its arms enter the hopper, blocks upon them strike an inclined plate attached to the inner surface of the rear side of said hopper and depress said rear side. As the blocks slip from the inclines the elasticity of the spring raises the hopper with a jerk, shaking down the seed. As the arms of the plate move down through the hopper, the saw teeth draw out a quantity of the seed. To the center of the front cross piece of the frame is adjustably attached an opening plow for opening a deeper or shallower furrow to receive the seed.

Improved Head Block for Saw Mills.

Charles Leddel, Morristown, N. J.—In this improved log setting apparatus there is a long toothed rack on the back side of the log beam, parallel with it and movable in the direction of its length. This rack gears at each head block so that by its movement the log beam will be moved forward or back alike on all the head blocks. The pinion shaft at the head of the carriage rises as high or higher than the hight of the largest logs, and has a ratchet wheel on its upper end, with which wheel is a pawl lever and other mechanism, for actuating the lever from the sawyer's position in front of the saw, and to prevent the back pressure of the log from turning the ratchet wheel, all being arranged so that the aforesaid wheel may be worked by the sawyer to set the log and shift the log beam back for a new log. The invention also comprises a knee for setting out the log to saw tapering stuff, worked independent of the aforesaid apparatus, which is for setting the log to be sawed into stuff with parallel sides. The device also comprises a novel arrangement of a scale and movable pointer to show the distance of the dogs from the saw and guide the operator in setting the log.

Improved Reel Rake for Harvester.

Munson K. Church, Stamford, Canada.—This invention has for its object to furnish an automatic trip for opening the gate or operating the lever that controls the rake of a harvester, and which is so constructed that it can be set to open the gate each time, at every second, third, fourth, fifth, or sixth time a rake passes the table.

Improved Organ Case.

George Woods, Cambridgeport, Mass., assignor to himself and George P. Carter, of same place.—This invention consists, first, in a construction of the front projection of the organ, calculated to expose the keys and stops very prominently to view, when seen from the ends, thereby greatly increasing the beauty of the instrument. This construction is also designed to dispense with the projecting front. The invention consists, secondly, in a novel construction of the "key slip" or fret work piece in front of the keys, also of the ledge or projection below, whereby the said "key slip" and ledge are extended around the corners so as to show the aforesaid end views in a manner to lend additional features of beauty to the instrument; and, thirdly, in a construction of the fall or cover whereby it is adapted to the peculiarities of the organ front above mentioned.

Improved Cotton Press.

John T. Williams, Blakely, Ga.—This invention is an improvement in the class of cotton presses wherein two followers are simultaneously operated in opposite directions by means of toggle levers. When the windlass is turned by hand or otherwise, a pin will be moved with the band forward or backward, according to the direction of rotation of the windlass. When the pin is moved backward—that is, away from the press—it will cause the toggle levers to be vibrated so as to force the followers together, and compress the contents of the press. When the pin is moved toward the press it will cause the toggles to draw the followers apart to allow the removal of the bale and the insertion into the press of fresh material to be pressed.

New Combined Water and Liquor Cooler.

William A. Jones, Erie, Pa.—This invention has for its object to furnish an improved cooler which shall be so constructed as to enable liquors to be cooled by the same ice that cools the water. The body of the cooler, in which the water and ice are placed, is made with double walls, the space between said walls being filled with suitable non-conducting substance. The body of the cooler is provided with a faucet, through which the ice water is drawn out, as required. In the cover are formed holes leading into sockets, the upper ends of which are attached to the cover, and which are made of such a length that their closed lower ends will not touch the bottom of the cooler, so that there may be a space for ice water between. In the bottoms of the sockets are placed coiled springs, upon the upper ends of which rest the bottles that contain the liquors to be cooled. To the cover, around the holes in which the bottles are placed, are secured rubber rings, so as to fit snugly upon said bottles, and prevent the entrance of warm air into said sockets.

Improved Breech Loading Fire Arm.

Francois Gueury, Paris, France, assignor of one half his right to Ernest Dubois, of same place.—This invention relates more especially to that class of breech loading fire arms in which the breech is closed by a bolt, which has a sliding movement in the line of the barrel for opening and closing the breech, and a movement about its axis for the purpose of locking or unlocking it. The invention consists in the provision of an arched shield or cover which is susceptible of being turned laterally by the axial movement of the breech bolt for uncovering the breech receiver, in which position it is retained when the breech bolt is drawn back, and again returned to its normal position by a reverse movement of the bolt when the breech is being closed.

Improved Grate Bars.

James A. Sinclair, Bridgeport, Ohio.—The invention consists in pivoting one end of each bar to a vibratory cross piece, while the other end slides loosely in grooves of another cross piece. The object and effect of this mode of putting together a grate is to allow convenient room for the expansion and contraction in the bars themselves, and to afford increased facility in maintaining the interstices clear of all deposit.

Improved Lubricating Compound.

Henry R. Hutchinson, Empire Iron Works, Ky.—The object of this invention is to furnish a compound for lubricating car axles and similar frictional surfaces, which shall prevent the friction and heating of axles and boxes, and be lasting and durable when applied. It consists of tallow and mineral oil, melted and burnt until the more volatile or light portion has been consumed and all watery particles vaporized and expelled, and the melted tallow or oil is reduced to the required consistency. It is then allowed to cool until it becomes semi-fluid, when pulverized sulphur, pulverized plumbago, animal charcoal and hydrated lime are added. The composition is mixed by grinding, when it is ready for use.

Improved Furnace for Locomotives.

Thomas Davies, Cleveland, O.—This invention relates to a new and useful improvement in the furnaces of locomotive steam boilers; and consists in the means employed for supplying atmospheric air to the fire box. An arch extends across the front of the fire box, and extends back toward the fire door one half the depth of the fire box, the crown of the arch being just beneath the tube section. The doors or apertures are placed just below the arch. This arch confines the admitted air and forces it to mingle with the smoke and gaseous products of combustion.

Improved Manger for Horses.

Joseph C. Higgins, Millstone, N. J.—The object of this invention is to so construct a manger for horses that the horse will be prevented from biting or gnawing it, and from what is known among horsemen as "*cribbing*;" and it consists in pivots or journals in the ends of the manger by which the manger is supported and on which it freely turns.

Improved Chill for Casting Smoothing Irons.

James F. Bless, Newark, N. J., assignor to himself and Robert Drake, of same place.—This invention relates to a new form of mold for casting a smoothing iron in, with the object of obtaining a chilled surface for the entire iron. The inventor obtains the desired result by making the mold jointed and applying the hinge at one end, so that it can be freely opened to release the iron and handle when finished. The invention also consists in providing the mold with a certain advantageous form of handle, which relieves the hinge from strain during expansion.

Improved Cigar Tuck Cutters.

Le Grand Scholfield, Providence, R. I., assignor to National Cigar Machine Company, New York city.—This invention consists of a machine for automatically feeding, adjusting, cutting, and discharging cigars, in which the cigars are placed on an *intermittingly* acting endless carrier, and delivered by it into or upon a cutting bed, when a plunger pushes them along the right distance for presenting the "tuck" ends to a pair of cutters, which cut off the said end, and there a discharger ejects them from the bed, the said discharger at the same time opening a discharge passage by raising a movable side of the bed, used to prevent the cigars from bounding off when falling upon said bed, and closing it again ready for the next.

Improvement in Producing Chlorine.

Louis Emile Aubertin, Paris, France.—This invention relates to a new process for producing chlorine by causing a mixture of air and gaseous or liquid ydrochloric acid to pass over sesquioxide of chrome, heated, by preference, oab temperature of about 600° Fahrenheit.

Improved Truck for Moving Buildings.

William E. Walker, Albion, Iowa.—Two broad truck wheels are fixed on the axle with a space between them, which admits the sand board. This sand board rises up to the surface of the wheels, and the board bolster rests thereon. The upper end of the king bolt projects above the bolster and plate, and is a little tapering, and is intended to enter the under side of the sill of the building to be moved. The regulating arms are attached to each end of the bolster, to which they are firmly secured by iron straps. Stay braces are so attached and *connected* with the axle and sand board that the bolster may be turned to the right or left, as may be desired, to vary the direction of the building. By means of holes in the bolster, the bolster may be attached to the sill of the building by screws. The truck will run on a track, laid for the purpose, of planks or timber. Chains are attached to the ends of the axle, or to the linch pins and to the regulating arms when the line of motion is straight. When it is necessary to turn in either direction one of the chains is let out and the other one is taken up, so that the bolster is held stationary in any desired position. Four, more or less, of these trucks are placed under the building to be moved.

Improved Machine for Making Baskets.

James Moore and Samuel W. Day, Oak Creek, Wis.—This invention has for its object to furnish an improved machine for use in making splint market baskets, laundry baskets, etc., for turning up the sides and putting on the hoops, enabling the baskets to be made rapidly. The invention consists in the table upon which the woven splints of which the basket is to be made are laid, and which should be of the size required for the basket, so that the said woven splints may be cut off to the desired size before the sides are turned up. The woven splints are secured to the table by a form which is made of the exact shape and size of the bottom of the basket. To the center of the form is secured a bar so arranged that it will always move up and down in a vertical line. The upper end of the bar is pivoted to a lever, to the free end of which is attached a cord that supports a weight sufficiently large to raise the form away from the table when the lever is unlocked for convenience in removing the basket. The lever is locked to hold the form down firmly upon the woven splints by a bar to rest upon the said lever and press it down. The sides of the basket are turned up over the edges of the form, and are held in place by flaps hinged to the table. A form, which slides up and down upon the bar, is made of such a shape and size as to fit into the mouth of the basket. The form is bound with an iron hoop, and around it is placed the inner hoop of the basket. After the corners of the basket have been woven, and the form and inner hoop lowered into place, the outer hoop is placed around the mouth of the basket, and is secured in place by the clamps, one leg of which is inserted in a hole in the form, and in a screw hole in the end of its other leg is inserted a hand screw, which is screwed against the said outer hoop. The outer and inner hoops are then secured to each other and to the body of the basket by nails driven in through the outer hoop, which are clinched by being driven against the iron band of the form.

New Machine for Chamfering and Crozing Barrel Staves.

Joel W. Jones, Middleport, Ohio.—This invention consists in certain improvements upon machines for crozing barrel staves. The machine is composed of the end cutting saws, chamfering cutter heads, and grooving saws; also of stationary curved beds on which the staves are held and carried during the operation by projecting pins on rotary feed disks; and also of a vibrating feed dash, which places the staves upon the curved bed in the requisite order. The grooving saws cut a square crozing, which will be adapted to receive the full edge of the barrel head and insure greater firmness and durability of the barrel.

Improved Wheel Plow.

Harlow M. Freeman, John Lowe, and John F. Stevens, Lathrop, Mo.—This invention has for its object to furnish an improved wheel plow, simple in construction, convenient in use, easily controlled, and effective in operation. The wheels revolve upon the journals of the axle and the one that is to run in the furrow is made slightly larger than the other. The axle is made deep; the journals are so arranged that the frame work, when the machine is at work, may run level. The axle frame consists of bars which form a rigid frame, rigidly attached to the tongue. The plow beams are curved downward, upward, and downward, and to their rear ends are attached the plows. The arms of the U shaped guide bars are slotted longitudinally, so that the plow beams may have a free vertical movement while being held against any lateral movement. By this construction the plow can be raised from the ground by operating either a foot lever, or a hand lever, or both. When the plows are fully raised a bent lever locks itself and thus holds the plows raised, in which case, by moving the foot lever slightly with the foot, the plows will drop to the ground. Suitable arrangements cause the plows to work shallower or deeper in the ground.

Improved Horseshoe Nail Machine.

Albert D. Bingham, Vergennes, Vt.—This invention consists of a machine comprising two pairs of rolls with dies and one pair of plain rolls, or it may be hammers between the two pairs with dies. The first pair have grooves of the width of the body of the nail to be formed and suitable depth for the thickness, with depressions at suitable intervals to form the necessary enlargements for the heads, but only the same width as the shanks. The second pair are plain and arranged at such distance apart as not to affect the shank, but to flat down the head to some extent; and the third have grooves of the requisite width and depth for finishing or nearly finishing the body with wider and deeper shapes for the head, to complete the reduction of the blanks. These are to be formed from a rod or bar of suitable size, the blanks being connected at the heads and points when they escape from the rolls, to be separated and finished at the points by punching dies to be used for cutting them apart and trimming or finishing the points at the same time.

Improved Folding Chair, Bed, and Ottoman Combined.

Eugene Fauh, New York city.—This invention relates to a new folding bedstead, which when folded together will produce an ottoman, and therefore be in the most contracted form possible, and which when extended can have its head piece raised and its foot piece lowered to form a convenient easy chair. The invention consists in forming the bed in three jointed sections, which contain at their under sides the supporting legs that can be folded under them respectively, each leg when extended being stiffened by jointed braces that connect it with the section to which it is attached, so that a strong and reliable support will be given to the bedstead.

Improved Knitting Machine.

Hugo Gunther, New York city, assignor to himself and Charles Lupprian, of same place.—In this machine the needle bed is extended downward, and also the grooves in the same, for the reception of an additional series of needles, which are pusher or setter needles only, for pushing the latch needles up, the downward motion of the latter being produced by wing cams directly moving the same in the ordinary manner. The invention consists, also, in a new arrangement of cams in the lock of the slide or carriage of the knitting machine, in which arrangement the upper or wing cams are set as usual to move the latch needles downward while in the lower part of the lock. The V shaped driving or raising cam is set further down than usual, in order to apply to and operate the setting needles, and not to the latch needles. This will, of course, allow power to be applied to the setting needles, so that, when raised, they will move the latch needles. The latter will thereby be greatly protected, and if any injury is done by the elevating cam it is only done to the setting needles, which are inexpensive and easily replaced.

Improvement in the Extract of Yucca.

Louis G. Fellner, Las Vegas, New Mexico.—This invention has for its object to furnish yuccatin or extract of yucca root, so prepared and put up that it will be protected from moisture, and may be put into market as an article of commerce; and it consists in yucca root ground, steeped in water, and pressed. The liquid thus obtained is evaporated to the proper consistence, and then molded in forms. Yuccatin cleans the skin, hair, wool, and other animal substances from foreign matters without destroying their softness. Samples, neatly prepared by Dr. Fellner, have been sent to this office, and from what he says of his extract it seems to have peculiarly good properties.

Improved Pedal Attachment for Pianos.

Charles W. Held, Jr., and Alphonso M. Baugh, Brooklyn, N. Y.—This invention consists of a vertical bar adjustably attached to the pedal frame, with a vertically adjustable foot rest supported on it, having pedals upon it and rods extending from the pedals down upon the ordinary pedals through suitable guides, and having certain controlling springs, all constituting a very simple and efficient attachment, to enable children to work the pedals and so contrived as not to interfere with the working of them by adults without the attachment.

Improved Die for Capping Screws.

George W. Briggs, of New Haven, Conn.—This invention has for its object to furnish an improved die for capping screws. By suitable construction should the edge of the circle piece be battered or worn, it may be turned, and, should the slot in the screw head not be exactly true, the said circle piece can adjust itself to said slot. By this construction, also, a spring will allow the guide or circle piece to yield and be forced down into the rest should the slot in the screw head be shallow, or otherwise defective or wanting, so that no part of the die need be broken.

Improved Scroll Saw.

Frank H. Hardenbergh, Hawley, Penn.—The invention relates to a new construction of saw blade for use in scroll sawing and other fine work, and consists in filing a double set of teeth on the cutting edge of the saw by a series of oblique incisions in opposite directions, whereby the saw is made more effective, and whereby it can be sharpened on an ordinary grindstone in the same way as other edge tools are sharpened.

Improved Wheel for Vehicles.

Hiram Kellogg, Floyd, Iowa.—The invention consists in securing the inner ends of the spokes in tubular projections of rings that are adjustable on the hub, so that said rings can be set closer together on the hub the more the felloe is expanded, and the spokes placed more in line with the rim, to b adapted to the larger diameter of the wheel.

Improved Exhaust Valve for Air Brakes.

William Riley, Terre Haute, Ind., assignor of one half his right to Charles R. Peddle, of same place.—This invention has for its object to furnish an improved valve, designed especially for the escape of air or steam from the brake cylinders upon railroad cars, to allow the air or steam to escape instantly and simultaneously from the cylinders of all the cars. By suitable construction, when the engineer admits the air or steam it presses open the ingress valve, and passes into the cylinders, and at the same time holds the exhaust valve firmly to its seat. When the engineer lets off the air or steam from the inlet pipes, the pressure in said pipes will be instantly reduced, and the expansion of the air or steam within the cylinders forces open the exhaust valve and allows the said air or steam to escape into the air through the openings. By this construction, the air or steam will escape instantly from all the cylinders, withdrawing all the brakes at the same time.

Improved Balanced Slide Valve.

Thomas Beesley, Muscatine, Iowa.—This invention consists of two valve seats on opposite sides of an elevation above or projection from the ordinary valve seat, with a slide valve upon each seat connected by pressure bars at their ends, which project beyond their seats, by temper screws, which adjust the valve so as to work steam tight on the seats, and so as to relieve them of the pressure of the steam on the valves, which is mainly sustained by the pressure bars.

Improved Crib Attachment for Bedsteads.

Edwin F. Bryan, Savannah, Ga.—This invention has for its object to furnish an improved attachment for bedsteads, to form a bed for a child, or to form a table or support to receive articles required by an invalid. It is simple in construction and convenient in use, being readily detached when not required.

Improved Soldering Iron.

James D. Norton, St. Louis, Mo.—The object of this invention is to improve the common tinner's soldering iron, and to render it easy to renew or change the copper; and it consists in a shank which screws into the copper, and in a sleeve screw which screws to the copper, and in a holding nut on the shank. By this arrangement a variety of coppers may be kept on hand and used as occasion may require, as the copper on the shank is readily detached, so that a new one or a different form may be put on.

Improved Grocers' Sample Case.

N. Barker McCreary, Phelps City, Mo.—This invention relates to a new box or case to be used by grocers and others for containing and displaying spices and other goods and the prices of the same, and for protecting the contents against injury from atmospheric influences, insects, etc. The invention consists in providing the box with a sliding glass top, through which the contents can be inserted, removed, and inspected, and in combining it with a shield or plate near one end for indicating the price of the contents.

Improved Ejecting Apparatus for Bottles.

William S. Ward, New York city.—This invention consists of a simply contrived force pump, let into a perfumery or other bottle or vessel, with its stem or piston rod passing through the cork or stopper in such manner that by suddenly pushing the rod down a small quantity of the fluid in the bottle will be ejected, preferably through the piston rod made hollow for the purpose, constituting a simple and convenient contrivance for perfuming the handkerchief and other articles, and calculated to prevent the waste of perfume which takes place when the stopper is removed.

Improved Sliding Support for Clothes Lines.

Michael Bubser, Jersey City, N. J.—This invention relates to an improvement in the class of supporters for clothes line holders consisting of a slotted bar provided with one or more pulleys, the same being in practice so applied that two lines pass through the slot. The improvement consists in adapting the support by dividing or cutting through one of the sides to form a spring, whereby it can be pressed inward.

Improved Fluting Machine.

David R. Saunders, Houston, Texas.—This invention relates to a machine for fluting or crimping articles of ladies' apparel; and consists, mainly, in a gage which is attached to the bed piece, by means of which the width of the fluted part is regulated. By the use of the gage the flutes in the article are made to terminate in a straight line, and the fluted part may be located wherever it may be desired. The article to be fluted may be spread over the bed, and the gage adjusted thereon to govern the position of the roller.

Plow.

John Love, Cusseta, Texas.—This invention consists in the mode of applying several plow irons to the same plow frame, so that they may be conveniently fastened and adjusted relatively to each other.

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

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Wanted—An experienced manufacturer of Door Locks and light hardware, with $10,000 Capital, to take charge of Shops. Edward Rowe, Jr., Mansfield, Ohio.

Wanted—The address of the manufacturer of Cotton Gin Saw Sharpeners. P. Kyle, Tuskegee, Ala.

Tin Ware Manufacturers should see the patent Weighing Scoop. For Sale, or Worked on Royalty. D. H. Priest & Co., 3 Tremont Row, Boston, Mass.

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

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Notes & Queries

1.—Our correspondent, T.W. Bakewell, who addresses us on the subject of calculating strength of boilers, refers to a letter of Professor Henry upon the subject. We also have been informed that Sir William Fairbairn has furnished a letter on the same subject. We should like to be able to publish these letters, as the opinions of those gentlemen, when correctly presented, are entitled to unusual consideration, and the fact of the existence of skepticism in relation to the proposition of our correspondent, on the part of nearly all well known engineers, will secure for them unusual attention.

2.—S. asks how to get sulphate of nickel and how to convert it into a nickel solution?

1.—H. J. H. asks: How can I give a brilliant black finish to a quantity of wire goods, such as hair pins?

3.—F. C. would like to know how to temper a steel screw driver, that has been put in the fire by mistake.

4.—A. T. Y. asks: Is there any preparation with which I can blow a bubble (similar to a soap bubble) strong enough to bear being knocked about the room?

5.—D. R. W. says: Can any one tell me of a process by which common pitch may be purified for optical purposes, such as polishing lenses and specula?

6.—W. N. asks for a detailed description of the cupola furnace designed by Henry Kriger, of Berlin, Germany, mentioned in the SCIENTIFIC AMERICAN a few months ago.

7.—D. asks: How can I color extract of lemon a light yellow in manufacturing it? By manufacturing it from oil of lemon and alcohol, and exposing it to the light, it will fade nearly to white.

8.—T. N. says: When a bevel wheel is being geared with wooden cogs, what method is adopted, when turning off the outer ends, to find when the pitch circle is of the proper diameter?

9.—S. D. P. Jr., says: How can I make a cheap coloring material to apply to paper or board, a sort of sizing; also a cheap varnish for the same? For varnish I have used alcohol and shellac, but it is too costly.

10.—H. asks if there is any way to make a fountain something on the principle of Hero's, as explained in the school books on philosophy. "I wish one to set on a table for decoration, and Hero's will not throw a stream high enough."

11.—S. asks: Which is the most probably true and best established theory in regard to the polar attraction, its causes, etc.? Is the idea that the atmosphere, acting as a prism, condenses all the violet light of the spectrum at the poles and thereby magnetizes them, at all reasonable?

12.—C. A. S. says: Given a cylinder of the internal capacity of 1,000 cubic feet: if I force ordinary illuminating gas into it to a pressure of forty pounds to the square inch, how many cubic feet of gas will it contain? In other words, if I had taken the gas through an ordinary meter, how many feet would the meter have registered? Can you give a rule for finding the number of feet at any pressure?

13.—J. E. G. says: In your issue of February you answer to G. W. D.'s question "will a wagon be as easily drawn by a long as by a short rope" that there is no difference. Now suppose I receive a dray load of each, rope and sugar, which must be drayed up a long hill. The drayman loads the sugar on the wagon, then attaches the team to one end of the rope and the wagon to the other; can he haul my two loads of goods at one time? Will I get the rope and sugar hauled for the price of hauling the sugar, according to your answer?

14.—D. H. S., Jr., says: Most of the wheat produced here is generally of good quality, but contains considerable smut. In many cases this infection has been avoided by steeping the seed grain for 24 hours in a solution of blue vitriol. For eight bushels of seed about one pound of the copper salt is used with enough water to cover the grain. As a preventive, this seldom fails. Can any of your readers tell us how to remove the smell and taste of smut, by a method practicable with considerable quantities of wheat? We have heard that quicklime is used. Is that the best deodorizer, and if so, in what proportions and how ought it to be applied? We have machinery which removes all visible smut.

Answers to Correspondents

H. M. says: In view of the fact that light will preserve the original color of white paint inside a house, while its exclusion will turn it a deep yellow, we asks you for a solution. Answer: The action of light is to bleach all colors which are not of fixed mineral origin. White lead being already white remains unaffected in the light, but in the dark it gradually absorbs sulphur from coal gas or other sources in a room and turns black. Zinc white is not so readily changed in color.

D. B. asks: Would the sulphuric acid in plaster applied in any quantity liberate phosphorus where it is combined with iron in the soil? Where and at what price can Fresenius' "Chemical Analysis" be had? Answer: Sulphuric acid in combination with lime in plaster cannot liberate phosphorus. Free sulphuric acid decomposes phosphates and is employed for that purpose. Wiley and Son, New York, are the publishers of Johnson's translation of Fresenius' "Chemical Analysis."

C. J. K. asks: What chemicals will keep water as near as possible to freezing point without going much below it? What work on chemistry would give me the most instructions on freezing and thawing? Answer: Ice floating in water is the only "chemical" that will keep the water as near as possible to freezing. When that melts, the water will assume the temperature of the room in which it is placed. Good books on chemistry have been written by Towne, Barker, and Eliot and Storer.

J. W. B. asks: How long will human bones, the skull for instance, preserve their form in the open air, or buried in moist earth? Answer: The precise time cannot be stated. Human skulls have been found in caves associated with the bones of extinct animals, in such a way as would indicate an antiquity of many thousand years. The skulls in the catacombs of Rome are known to be very ancient.

C. T. S. says: I have a fine scale, enclosed in a glass case. What shall I place in the case to absorb the moisture, to prevent the steel parts from rusting? Can you tell me the cheapest way of making sulphurous gas in large quantities, and what would be the best manner of keeping it, and how long does it remain in fit condition to use as pure gas? Would a bladder or India rubber bag answer for a gage, attached to the vessel in which the gas is stored, to indicate what quantity was always on hand? Answer: To prevent chemical balances from rusting, put a lump of quick lime in the box containing the instrument, in a saucer. It will absorb the moisture and finally swell up and become air slaked; it must then be renewed. We give elsewhere a process for the manufacture of sulphurous acid on a large scale. It is difficult to store it in anything but glass vessels.

P. M. asks: What is the rule for finding the sag of a belt, passing over two pulleys, with their centers say 100 feet apart? The belt is to stand on the rake, the center of the upper pulley being 10 feet out of plumb with the center of the lower one. The lower pulley is 2 feet and the upper one, 4 feet diameter. The belt is of four ply rubber, and 22 inches wide and tightened in working order. In some cases it is important that this should be known. The late lamented, long-winded Rankine, gives the rule, but the hieroglyphics in which it is given are all Greek to me. Now I have a pretty fair knowledge of theoretical and practical geometry and arithmetic, and Irish, English and French, but I am puzzled with nearly everything in Rankine's works. Answer: The rule referred to may be translated thus: Divide the square of the distance between centers by eight times that length of belt which would give, by its weight, a strain equal to the tension on the belt, and the quotient will be the deflection below the straight line joining the centers of the two surfaces carrying the belt. If our readers desire to accomplish much in mechanics, and to avoid the troubles of our correspondent, they will find it well worth their while to devote a good share of leisure time to mathematics and the principles of natural philosophy. They would also be better prepared then to appreciate the labors of Professor Rankine, who has earned a splendid fame by pursuing just such a course.

W. H. G. is making a toy engine and boiler and says: The size of boiler is 3x5 inches; it is made of tin; now would I gain anything by fixing 3 or 4 half inch tin tubes or flues in the bottom of boiler four inches long, or is a common flat bottom better? The tubes are to be closed at one end. How would air work, pumped into a boiler at bottom or top (in steam space) or will it not work at all? How much does air expand? Answer: The proposed tubes will be likely to increase the power of the boiler as they increase the heating surface. Tubes closed at one end are sometimes used, and where the fire is not forced, do well. If the fire is forced, they are defective in not allowing free circulation of water. Introducing air in so small an apparatus would probably not pay for the trouble involved. Look in a recent number of the SCIENTIFIC AMERICAN for answer to last question. We hope to be able to help thousands of others among our young readers as we have aided W. H. G.

J. McC. says: How can I measure a coal barge according to the government measurement? The barge is 124 feet long, 24 feet wide and 5 feet deep. Answer: The tunnage of a barge is legally measured by multiplying the length, breadth and depth together, to obtain the cubic feet of contents, and dividing by one hundred to obtain the burden in tuns (tunnage law of U. S. 1865 ("open vessels.") for registry. Thus, a barge 124 feet long, 24 feet wide and 5 feet deep would register 148·80 tuns. Such a barge would carry, of "dead weight," about 400 tons, if loaded down to the water's edge. It would have storage capacity for about 300 tuns of Cannelton coal, or for, say, 8,400 bushels.

A. B. S. says: I wish to use exhaust steam for heating or for boiling water. Can I immerse the end of exhaust pipe in water without any very great detriment to power of engine? The length of the exhaust pipe is 60 feet. Answer: For each two feet of depth of water, above the opening of the exhaust pipe, the engine will be subjected to an increase of one pound back pressure.

A. G. K. says: I have a boiler with 3 inch flues, which does not make steam as fast as I would like. Do you know of any objection to putting in 1½ or 2 inch flues between those that are in? Answer: The most serious defect of the tubular boiler, as frequently constructed, arises from the endeavor of the builder to increase its power by crowding too many tubes into it, and thus checking the circulation of water. It often happens that removing tubes is found to increase the steaming capacity of a boiler. We should doubt if the introduction of additional 1½ inch or 2 inch tubes into a boiler fitted with 3 inch tubes would afford advantages commensurate with the risk, which it might produce, of burning some of the tubes, even if it were to slightly increase the steaming capacity.

J. H. P. says: Will you let us know if there is any patent method of turning an engine off from the center without the use of a tackle? Please write what would be the cost of such a patent. Answer: Many devices are in use, but we know of no purchasable patent which covers one generally adopted.

NOVELTY GLASS CUTTER.—Letters of enquiry for this article come to us from all directions. We know nothing of it, or who sells it.

E. M. B. says: I want to know the simplest and surest manner of putting up long lines of shafting correctly; also, commencing at the engine, how to calculate the speed of pulleys of various sizes. Machines come from the maker with a driver pulley of a certain size, marked to run so many revolutions per minute. I want to know how to calculate the size of pulley on main shaft by which the machines shall be run. I suppose the speed of main shaft must be known. How can I find out that? Answer: Dub off the under sides of the beams to which the hangers are to be attached, or pack them up, until a stretched cord, or sighting along their line, shows them to be accurately in line. Put up the hangers in their places, and again try whether the center line of bearings is a straight and level line, adjusting any that are found out of place. Finally put up the shafting and set up the couplings. The best makers use swivel bearings that will adjust themselves to any slight deviation from line, and the couplings are made with an eye to the same contingency. The speed of shafting is, to some extent, determined by the character of the work driven. For heavy work a speed of 100 revolutions a minute is common, and for light work the speed rises often to 300, or even higher. The tendency is continually to higher speeds, in consequence of the fact that it allows the use of lighter belts and pulleys. The size of driver pulley is determined by multiplying the diameter of the driven pulley by the fraction obtained by dividing the speed of the driving line of shafting by that of the driven shaft.

W. S. B. The use of the common sewing machine treadle is not productive of special illness or discomfort if intelligently used. But there several forms of improved treadles that are claimed to have advantages, and they are on sale in your city of Boston. You will there also find, doubtless, sewing machines operated by springs, without treadle. In this city you may procure sewing machines which are operated by electricity. If you wish for devices not advertised in our columns, you might insert a few lines under "Business and Personal."

J. H. asks how much space there should be between piston and cylinder head of an engine with an 8 inch piston and 16 inch stroke. Answer: The space between piston and cylinder head, when the former is at either end of stroke, should be as little as possible where economy is aimed at. In a direct acting engine of the size given, a clearance of one eighth inch at the back end and three eighths at the forward head is a fair allowance with those whose workmanship is first class. Ports are made of from one tenth to one twentieth the piston area, being given the greater proportional area for high speeds of piston. Clearance, including space in steam passages of cylinder has, in rare cases, been reduced to 2 per cent of the cylinder capacity. In good engines, 5 per cent is a usual figure.

W. H. M. says: Is there any rule for estimating the thickness of material required to be used in constructing cylinders of certain diameters to withstand certain pressures? Of what kind of material and how heavy should a cylinder 18 inches diameter by 3 feet in length be to withstand internal pressures of 18 and 24 pounds per square inch respectively? Does the length effect the strength of the cylinder? How do copper and brass compare with iron for this purpose? Would the same cylinder withstand the same pressure externally? Answer: Any work on the strength of materials will give the desired information. We gave a list of such works at page 106 of our current volume. A cylinder of sheet iron, with single riveted joints, 18 inches in diameter and 3 feet long, would be made of about No. 22 or 24 iron, measured by wire gage, if intended to bear safely a pressure of 16 pounds, and of No. 20 or 21 for a pressure of 24 pounds. The length does not affect the power of resisting internal pressure, but it does influence greatly the power of resisting collapse. Copper and brass cylinders, with joints perfectly made with hard solder, have a strength about equal to single riveted iron cylinders, but the joints are rather more inelastic. Copper and brass are weaker than good iron. Expending a small amount of money in standard books will often save, in cases like this, considerable outlay in experiments which may have been already made with far greater accuracy and completeness by others. The first step to be taken, before commencing experimental research, is always to ascertain what has already been done by others.

B. says: A friend thinks the small steamers plying on the Thames (England) submit to the useless cost and complexity of having the wheels constructed for vertical position of the paddles. Answer: Some, not all, of the steamers alluded to have feathering paddles, and gain in speed by the adoption of that system.

T. N. asks: Will the reports of the Patent Office, which are to be printed every month, be for sale in the book stores? If not, where can they be got, and what is the price? Answer: The publication referred to by our correspondent is the *Official Gazette* of the Patent Office, issued weekly. It can only be obtained at the Patent Office, Washington, D. C. Subscription, $6 per annum.

F. A. S. asks: Will you tell me how to make "Coumarin"? Answer: It is prepared from "sweet vernal" grass (*anthoxanthum odoratum*) and is used for giving stronger aroma to other flower essences. Answer: Cut up the herb, and macerate in hot alcohol; strain through cloth, and distil off the greater part of the spirit. The strupy residue deposits, on standing, crystals of coumarin, which must be purified from fat oil by pressure, and then crystallized from hot water.

A. C. says: Enclosed please find specimen of ore, of which I would like to have the name and value. Answer: It is not an ore, but a variety of hornblende.

G. S. Y. sends a mineral specimen and asks our opinion of its quality. Answer: If the article is as homogeneous as the fragment sent, it will undoubtedly prove an excellent fire-clay. But "trying," on a large scale, "is the naked truth."

L. C. M. has read our article on pickles, published on page 145 of Volume XXVII., and would like to know how to make bright green pickles, free from suspicion of copper and sulphuric acid. He asks for a description of the method produced in manufactories. Answer: In a pickling establishment of wide renown the boiling is done in copper vessels, thickly coated internally with silver, and a very strong *malt* vinegar, prepared for the purpose, is used. The pickles are perfectly wholesome and pure, but they have not the bright green color, for which many foolish people sacrifice the quality and genuineness of what they eat.

J. G. B. says: On January 2, I sent you eight small rough stones, requesting you to inform me what they are, and their value. If you have received them, and No. 6 or No. 8 is a diamond, I would like to sell them, if you would be so kind as to send them to a diamond dealer in New York and take out $200 for your trouble, sending me the rest by express. Answer: J. G. B.'s quartz diamonds are at his own disposal.

J. S. and D. P. N. say: A., B., and C. wish to carry a stick of timber, 12 feet long and 12 inches square. A. and B. are in front with a hand spike, and C. brings up the rear end alone. Where should A. and B. be under the log, so that each man will have an equal share of the weight? Answer: 3 feet from the end of the bar opposite to C.

S. R. K. says: I have a small lead pipe leading down from a tank in the second story of my house into the cellar, to feed the water pan of my furnace. The lower end of the pipe is so much in contact with the furnace that the water there is a good deal heated. Will this heated water rise, and cold water from the tank pass down, in the same pipe? If this pipe does not pass down from the tank to the furnace by a regular descent, but runs for some distance horizontally, with several small rises and falls in the horizontal part, will that prevent the circulation of hot water up and cold water down, in the same pipe? Answer: The circulation of water in the manner described cannot occur where the pipe undulates as supposed, and in a straight pipe of a small diameter, as we presume this to be, such circulation could only take place very slowly indeed. A very moderate downward current would, we suspect, effectually prevent the ascent of the warm water. In a large pipe leading directly from top to bottom, a circulation would undoubtedly be likely to take place, the warm water being displaced by the heavier cold water, the latter settling at the bottom, the former rising to the top.

C. W. K. says: Imagine a body moving in one direction, then its course to be suddenly changed 180°, returning, in the same line it proceeded in, from the point of reversion. What I wish to know is whether a reciprocating body must necessarily stop when it changes its direction; for instance, a piston head in an engine? Is it a self evident fact that it must stop before returning, or is the following reasoning cogent, and a proof to the contrary? From A to B, two points of conceivable distance apart, are projected two bodies, C and D (one body from each point, towards the other) with sufficient force to carry them through the intervening space between A and B. C weighs ten times as much as D. They meet between the points, both running in the same line. As a natural consequence both bodies are found near B as C, having the preponderance, would convey D backward. Now according to the law of the inertia of matter, C could not have stopped intermediately, if found at B. Then did D stop when it changed its direction when met by C? Answer: It matters little practically whether it is considered that a body, whose direction is reversed, stops during an infinitesimal space of time, or does not stop at all. The question is too nearly a metaphysical one. In the case given, an indentation would be produced in the one or the other, or both bodies, C and D, and, so far as the argument is based upon natural facts, it is not conclusive. D might be brought to a stop while indenting C and then take up its reversed movement, finally moving backward with C. This is one of many examples, frequently presented, in which an argument is based on false premises.

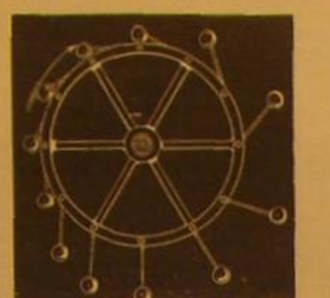
A. L. asks: Will an ordinary local telegraph battery make platinum wire red hot; and if so, how can I attach it? How can I make a galvanic battery out of the same? The telegraph battery is composed of two glass jars, copper, zinc, and blue vitriol. Answer: Why not disconnect the local battery and try the experiment? If you find that two cups won't answer, try more until you accomplish the result.

J. C. C. sends a specimen of boiler scale and asks why it is so hard. "I had it in a bottle of oil of vitriol for five hours, but it would not dissolve. We use about two hundred barrels of water per twelve hours, half of which is sulphur spring and the rest surface water, the largest portion of which runs through sewers accumulating all kinds of filth (human deposits) which makes the water in boilers foam very badly, so much so that the engines suck it up five feet and into the cylinders; but it does not make the pistons pound like some water does. I have put in surface cocks to draw the foam off, but they clog up with mud in two or three days. This scale formed on the boilers before I took charge of them, two years ago, and I have tried nearly everything that will loosen scale, with no effect. About nine months ago, the firm put in a heater and filter, by which I can get the water so hot as to require a small stream of cold water to condense the steam in the feed water, so that a No. 3 Cameron pump will force it into the boilers. There is not much new scale forming, but the old scale remains as fast to the flue as ever. We have hammered as much off as we could, but the boilers are so built that it is hard to use a hammer. They are four feet in diameter, twenty-eight feet long, with 2 twelve and 2 thirteen inch flues in each. We blow out every two weeks, and find the mud drum full of mud, very black and thin. We filter through hay packed tight. I have tried everything except taking the flues out of the boilers, and a steel square linked chain to take scale off. Answer: The boiler incrustation is sulphate of lime or gypsum, discolored with some organic matter. Oxalate of baryta is sometimes sold to purify water, but is too expensive for use on a large scale. If the water could be filtered through alternate layers of gravel and charcoal, it would help. When you are obliged to use such dirty water, the best way is to blow off more frequently, otherwise the deposit of gypsum in the flues will become unmanageable.

F. I. says: I have been reading the lectures of Professor Tyndall in your valuable paper, and am very much puzzled regarding his explanation of the complementary colors. I heretofore understood that the mixture of two primary colors was the complementary of the third. The Professor says that the mixture of the yellow and blue ray produces white light; if so, I would be very glad to know what is the use of the red ray as a component part of the illuminating power of the sun or any other white light. Answer: Professor Tyndall showed by experiment that the yellow and blue rays of the sun when combined produced white light, but he expressly stated that the same result did not follow when yellow and blue pigments are mixed. It was to illustrate this difference that he introduced the experiment.

O. A. B. says: In your article on balancing machinery, on page 33 of the current volume, you give a formula, and proceed to compute the centrifugal force of a crank, weight 500 pounds, with its center of gravity revolving in a circle of four feet in diameter, at the rate of fifty revolutions per minute. Correcting a clerical error, you would have: centrifugal force $=500(4\times3{\cdot}1416\times\frac{5}{6})^2\div(16\frac{1}{12}\times4)=852$ pounds. A few lines below you say: "Were it attempted to effect a balance by a piece placed opposite, at a double distance, but of half the weight, the counterbalance would have a double centrifugal force, and hence, although a standing balance would be obtained, it would not give a running balance." Let us try it: $F=250\times(8\times3{\cdot}1416\times\frac{5}{6})^2\div16\frac{1}{12}\times8=852$ pounds. Just the same, instead of double, and because it is just the same, it will of course give a perfect running balance, as well as a standing balance. It is thus shown that, in this instance, a standing balance and a running balance are secured by the same conditions, without regard to the *vis viva*. And this is equally true in all cases, as may be shown in any case by applying the formula as above, or it may be proved algebraically in general. This conclusion is of course based upon the supposition that no "couple" is produced by what I may call a diagonal balance. Answer: The erroneous calculation here corrected and the deductions therefrom have been pointed out and the proper statement of the laws of centrifugal force has already been given at page 81 and in an earlier issue of the SCIENTIFIC AMERICAN. No better proof that our paper has a circulation among the most intelligent of readers than the fact that this problem has attracted such prompt attention, and has elicited so many accurate statements of the principles involved, could possibly be offered.

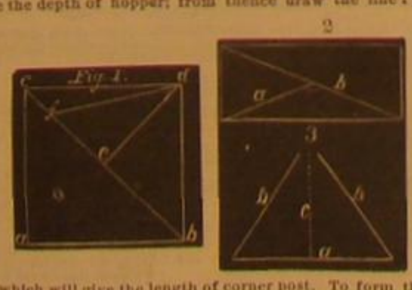
J. O. says: Seeing, in your paper for January 8, a drawing of a "perpetual motion," I will state that I made one, on the same principle but different in construction, several years since. I do not believe in perpetual motion, but I thought I could gain more



power than I should use. I found that the power gained in going down one side was used in going up the other side.

J. R. E. says: Here are two of your subscribers and three or four others in trouble about the velocity of falling bodies. Some would have it that large and small will fall through the same space in the same time, without regard to the resistance of the element they pass through, air or water, and they take Parker for their authority. The others admit this all, theoretically, in vacuum. But they say that there is difference in passing through the atmosphere, and more through water, in favor of the large bodies, owing to the resistance. These last take Comstock for their authority. We would like to have you settle the question. Answer: The abstract laws of falling bodies have been determined with perfect accuracy, both by experiment and by logical deduction from known conditions. When the falling body is uninfluenced by forces other than that of gravitation, when falling freely as if in a perfect vacuum, the velocity can be predicted with perfect certainty and precision. From this fact, it results that astronomy, its calculation being based upon these well established principles, is an exact science, and that astronomers determine the motion of the heavenly bodies, calculate the perturbations produced by their mutual attractions, and even discover, as did Leverrier and Adams, a new member of the solar system whose distance is so great as, despite its tremendous magnitude, to have been previously undetected by the telescope. In all familiar examples of the effect of the force of gravitation, however, we find the motion of bodies, moving under its influence, to be affected by the action of other and retarding forces, as the resistances of the air and of friction. In any given case, when these resisting forces can be exactly determined, in magnitude and direction, the motion of the bodies can still be determined precisely. In some cases, as that in which the air resists the motion of a body moving with very great velocity, it is difficult, or even impossible, to calculate the resultant motion with exactness, in the present state of our mathematical knowledge. Where no resisting forces occur, the velocity of any falling body can be determined by the following rule: Multiply the hight, in feet, from which the body has fallen by 64⅓ and extract the square root of the product. The result is the velocity acquired, measured in feet per second. Or, multiply the time, in seconds, that the body occupies in falling by 32⅙ and the product gives the velocity acquired. For all cases other than that just supposed, the velocity will be modified to an extent which will vary with each individual case. Generally, it may be stated that falling bodies of equal size but differing densities will fall through any resisting medium with differing velocities, in consequence of the fact that the lighter materials offer greater extent of surface to the resistance of the air or other opposing fluid, and, therefore, were retarded to a greater extent than are the denser substances. Where bodies of similar material, but of different sizes, are allowed to fall through a resisting medium, the larger will fall most rapidly for a somewhat similar reason. As an illustration, a sphere of two inches diameter contains eight times as much matter as does a sphere of the same material an inch in diameter, but it only has four times as much surface, and four times the cross section of the smaller ball. It therefore is less retarded and will be found to reach the limit of its fall first. In the air this difference is seldom noticeable; in the water it is more frequently observed, and it is for a similar reason that a large vessel requires less proportional steam power than does a small one driven at the same speed.

C. H. D. says, in answer to T. who asked how to construct a flaring vessel, such as a hopper: Fig. 1. Draw a square a b c d, the size of hopper at the top minus the desired size of hole to be left at the bottom, then draw the diagonal lines c b e d; then measure from e the depth of hopper; from thence draw the line f d,



which will give the length of corner post. To form the square, Fig. 2, take the lines e f and f d (Fig. 1); draw the diagonal lines a b, which will give the correct bevel for corner post line a. Fig. 3 is the full size of hopper at the top. Take the length of line f d (Fig. 1), for the lines b b, which gives the angle on which to cut the boards, and dotted line c is the required width. If it is not desirable to use corner posts, cut the ends of the boards to the bevel a b (Fig. 2), and set out the dovetail square from the end.

T. M. says to A. H. S., who asked for directions for building a warm and rat proof house: If you use sand to fill the space between the weatherboarding and plastering of your house, the pressure upon both plastering and weatherboarding can be lessened by inserting pieces of inch board between the studs, like shelves, a foot or two above each other, fastened with nails "toed in" at each end. They should extend to within one inch of the weatherboarding so as to allow space for the sand to run down and fill up. The liability of the sand to run out through cracks or warps in the weatherboarding may be obviated by tacking on to the studding, before the boards are put on, coarse wrapping paper, which can be had in rolls of great length and width at a cheap cost. Nail pieces of board vertically between the ends of the joists to keep the sand from running between the floor and ceiling.

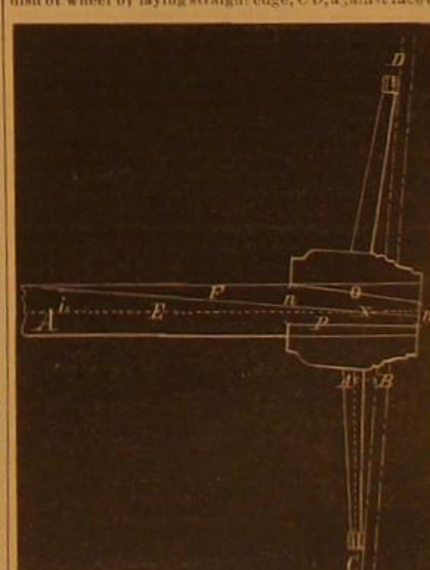
T. M. replies to D. M.'s question about a leaky roof: Your tin roof leaks, probably, because it is so steep that the solder runs down from, instead of up under, the lap; in that case the bond is but slight, and the remedy is a plentiful use of solder. Cover your parapet walls with a tin trough, inverted, (of convenient length), the inner side or flange being deep enough to extend over the roof tin where it reaches up the side of the parapet, and nail it to the joints between the bricks.

H. M. W. says: J. asks for a simple method of detecting explosive oils. The following is about the simplest method extant, and is sufficiently accurate: Pour into a cup about 2 inches of the coal oil to be tested; light a match and, when fairly in a blaze, throw it into the oil. Standard oil (say of 130 degrees) ought to extinguish the burning match, as would water or any fixed oil.

J. E. G. says: The best mode of analyzing such questions as the balance wheel controversy is to take the two extremes into consideration. One would be a perfect and true wheel and the other would be a wheel with the rim lying on the shaft at opposite points of the circumference, which would be no balance wheel at all, and could not be kept in its bearings because of its unequal distribution of weight from the center.

G. B. D. says, in answer to H. & B. who asked how to draw water 400 feet horizontally and 60 feet vertically without a pump; If a pipe or any suitable conductor be placed horizontally with its thickness below the surface of the water, it will naturally fill to the distance of 400 feet as required; at this point a reservoir should be sunk entirely below the pipe; then at the highest point (60 feet) put in an old fashioned wooden pump running its pipe down into the reservoir. The plunger of this pump should work at a point not to exceed 20 feet above the reservoir, and the valve should be near the bottom, so as to be always below the water in the reservoir.

A. B. says, in reply to H. C. K., who asked for a rule for laying off wagon axles, that the length of the spindle should be 3¼ times the diameter of the butt. The length of the hub should be nearly one and a half times its diameter. The spindle should taper just so that the bottom side of axle may be straight throughout its whole length, when the wheel stands on a plumb spoke; and every wheel should stand on a plumb spoke whether the bottom side of spindle is level or not. The product arising from multiplying one fifty-sixth by the diameter of the wheel will give you the proper amount of dish for your wheel; then the spindle should taper one inch in twelve. To lay off wooden axles, first obtain the dish of wheel by laying straight edge, C D, against face of



felloes; then, at the hub, measure back to the center of spokes, or to center line of spokes, if they are placed "dodging" as at A B, it being, for example, 1⅛ inches; then subtract one half the thickness of the felloe, ⅜ of an inch, leaving ¾ of an inch as the dish of the wheel. Then measure the diameter of wheel, it being say 42 inches; then the length of hub, say 12 inches; then the distance from center of spoke or line of spokes to back end of hub, 6 inches, the diameter of large end of back box being 3⅛ inches; then the small end of front box, which, in this case, should be 2⅞ inches. Then on axle stick A, make a line, E, the whole length of stick; then measure from end of stick the distance from center of spokes to front end of hub, in this case being six inches, and make point x, then from x measure half the diameter of wheel, or 21 inches, to l on line E. Then measure up the dish of wheel or ¾ of an inch; then draw line F from point last obtained through x; said line will be perpendicular to the face of the wheel, thus bringing the spoke on a plumb line. Now on line F measure each way from x, six inches to points n and m. Then with compasses set at 1⅛ inches lay off from n, the butt of spindle, and 1⅜ inches from m, lay off tip of spindle; then draw lines O and P, which will be the top and bottom of spindle. Then on line E from x, measure the track you wish, and then lay off other end of axle in same manner as described above. If a 1inch pin is used, allowance must be made for it on end of spindle. Give as little gather as possible, only be sure and give a little. After the wheels are on the axle, they ought to measure not more than half an inch farther apart on back side than on front, measured at the rim on a level line with center of axle. By following these rules you can make wheels track every time and be sure of an easy running wagon. Iron axles may be set by the above rule by using a straight edge with some screws in the ends, one set for either end of spindle.

T. H. C. says that if P. S. will wash his ether, that is, put in a bottle with water and shake it up; then pour off the ether after settling, he will find it will dissolve pure rubber. Perhaps he may be trying to dissolve the vulcanized rubber; if so, he might as well give it up. Washed sulphuric ether will dissolve pure rubber, unwashed will not.

J. E. S. says, in reply to J. W.'s answer on transmission of motion: I saw the thing tested in the summer of 1854, with the result stated in the communication to which J. W. takes exception, however new it may be to him.

A. O. says in answer to L. H. W., who asked how to temper small steel wire, one sixteenth of an inch in diameter and less, and one inch long: You may follow the method in vogue for small screws, pins and needles. Put them upon an iron plate which can be heated from below, or place them in a sheet iron drum, to be turned on a fire like a coffee roaster. With regard to the heat required, it necessarily differs according to the degree of tempering you want to impart to the steel. A yellow tempering color, in its various tints, is imparted to instruments that are to remain hard, such as razors, surgical instruments, lancets, pen knives, etc. Articles that are to possess elasticity and the hardness of a spring, need a violet or dark blue color, and in some cases, especially when a particular hardness is required, as is desirable for the edges of astronomical and physical instruments, it may be proper to conduct the tempering at such a low temperature that no color appears at all.

J. F. says, in reply to M. D. K., who asked for statistics of presses for printing cards, circulars, etc., that he uses a card printing machine that will print at the rate of 6,000 per hour. This is possibly true; but our answer referred to a press for all kinds of work, even printing on the thinnest tissue paper.

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 Correlation of Forces. By W. R. S.

On Certain Instances of Combustion occasioned by Superheated Steam. By E. R. D.

On the Secrets of a Kernel. By F. R. R.

On the Creeping Railway Problem. By C. T.

On Fast Printing Presses, and on an Improved Galvanic Battery. By J. F.

On the Recent Boiler Explosions By T. L. L.

On the Rupture of Cylindrical Steam Boilers. By B. W.

[OFFICIAL.]

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FOR WHICH

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WERE GRANTED FOR THE WEEK ENDING

January 28, 1873,

AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSIONS.

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

23,820.—Watch Case.—J. Boss. April 16, 1873.
23,862.—Cotton Press.—H. W. Randle. April 16, 1873.
24,032.—Sewing Machine.—J. Gray. April 30, 1873.

EXTENSIONS GRANTED.

22,809.—Baker's Oven.—G. C. Jennison.
22,885.—Harvester.—W. K. Miller. (r) 2,266.
22,885.—Harvester.—W. K. Miller. (r) 2,267.
22,885.—Harvester.—W. K. Miller. (r) 2,268.
22,885.—Harvester.—W. K. Miller. (r) 2,269.
22,885.—Harvester.—W. K. Miller. (r) 2,270.
22,890.—Carpet Sweeper.—N. B. Pratt.

DESIGNS PATENTED.

6,368.—Monument.—W. T. Cross, Kewanee, Ill.
6,369 to 6,372.—Stoves.—C. Harris *et al.*, Cincinnati, O.
6,373.—Iron Fence.—M. Krumm, Columbus, Ohio.
6,374.—Governor Base.—W. B. Le Van, Philadelphia, Pa.
6,375.—Sewing Machine.—G. Rehfuss, Philadelphia, Pa.
6,376.—Cover Handle.—R. B. Wardin, Philadelphia, Pa.
6,377.—Cooking Stove.—H. A. Wood, Bangor, Me.

TRADE MARKS REGISTERED.

1,107.—Writing Paper.—A. Beach, Iowa City, Iowa.
1,108.—Pruning Shears.—Christy & Hughes, Clyde, Ohio.
1,109.—Cigars.—F. De Bary & Co., New York city.
1,110.—Spoons, etc.—Hall, Elton & Co., Wallingford, Ct.
1,111.—Cigars.—S. Jacoby & Co., New York city.
1,112.—Bitters.—W. H. Knoepfel, New York city.
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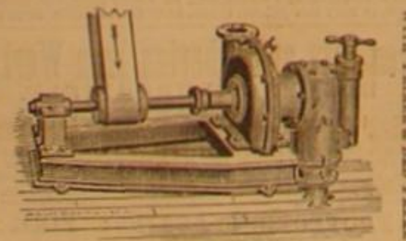

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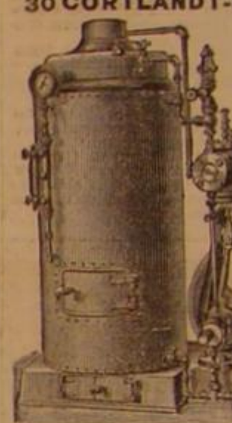

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