nomena of nature can be traced to chemical forces. When atoms are brought in contact we always have heat, frequently light, and probably generally electricity, and thus the forces we call physical really belong to chemistry. This is what we meant when we said that chemistry was destined to absorb many other sciences.

It is a common habit to speak of mathematics as an exact science, or to intimate that chemistry has no claims to a similar honor, but recent investigations have gone far to place chemistry among the exact sciences. The forces acting in it are well understood, the results are constant, the laws capable of precise statement—and of late years higher mathematics have been made to play a conspicuous part in chemical investigations. The faculties of the mind are admirably trained by a science that requires the closest observation, quick perception, accurate reasoning, and sound judgment. These faculties were less cultivated by the ancients, and hence the small number of discoveries made by them.

As the laws of chemistry become better known, we are enabled to explain many geological phenomena and to understand the constitution of minerals. Medicine and physiology and all the laws of life are better interpreted since chemistry has taken a part in their study. It is somewhat remarkable that a science which affords us nearly all the comforts we enjoy in our households, that has given us our glass, our paper, our food, our wealth, and, in fact, our civilization, should play such a small part in the instruction in our schools. But notwithstanding the disadvantage of such neglect, it makes a path for itself by its importance to the progress of society. The remark is often made that the child of the present age is the same as the child of two thousand years ago; and those who assert it mean that the school-boy now-a-days must begin as low down in the scale of knowledge as the Roman lad of the Augustan age. There is great fallacy in such a statement. When we meet a boy of the present time wending his way to school, with his books strapped into a bundle, if we stop him and examine his pack, we shall find in the most elementary treatise he carries, scientific information that was only known to the most learned philosophers among the Greeks or Romans. What was then acquired as the highest degree of knowledge, is now in every school-book, and thus our boys begin where Plato and Aristotle left off, and Pliny is only quoted for the droll mistakes he makes in his natural history. The new rector of the University of Vienna recently called attention, in an address, to the backwardness of the ancients in the sciences. This backwardness he ascribes, firstly, to an actual want of the power of accurate observation; and, secondly, to a restless spirit of speculation. He illustrates his remarks by referring to the observations of the ancients on the stars. The highest number recorded by them as visible to the naked eye was 1,600, whereas our school-boys can easily point out 3,000; and there is the same extraordinary discrepancy in the enumeration of the nebulæ, and the number of stars in the constellations.

It is an interesting question how far we inherit a schooled eye from ancestors trained in the observation of external objects, and how early science may be taught to children. A writer in *Nature* takes the ground that it is proper to begin at 8 or 9 years. On this point he speaks as follows:

"An ordinarily intelligent boy or girl of 8 or 9 years is perfectly capable of understanding the broad differences between the animal, vegetable, and mineral kingdoms; that there are more gases than one in the world; that some of them are colorless, while others are brown or green; that some burn, and others do not; that some plants grow from the inside, while others grow from the outside; that some animals have jointed back bones, that others have their bones outside their bodies, while others have none at all. Facts such as these are perfectly comprehensible to children even younger than those I have named. During the first two years of a child's school life, after he has learned to read and write, he should be carried through the whole range of physical science in a systematic manner. The fundamental truths of chemistry and physics should be first taught him; all theoretical considerations being left aside. As few definitions as possible should be given; the whole task of the teacher at the commencement being to cultivate the child's powers of observation to the utmost. Gradually the powers of induction and deduction may be developed; facts and phenomena should be compared, and conclusions drawn from them. There is nothing a child likes so much as investigation, or 'finding out all about things,' as he himself would phrase it. The boy in the nursery rhyme, who cut the bellows open to see where the wind came from, is a type of his class."

More mistakes are made by inventors, mechanics, and practical men, from a want of a knowledge of the elementary principles of chemistry and physics, which ought to have been taught them in childhood, than from ignorance of the higher principles of science. Chemistry is really a very easy and simple study. It only requires that the pupil shall have eyes and use them—and where a boy can see and won't see, he ought to be made to see.

It is a great mistake to try to commit to memory the names of everything in creation; the true plan is, to acquire a knowledge of the principles on which the combinations are founded, and let details take care of themselves; and the time to acquire this knowledge is in childhood, when the memory is fresh and the intellect quick to grasp information, and the eye readily observes what is passing in the world around us.

Chemistry is at the foundation of our prosperity; let us have more of it taught in our schools.

IT is intended to introduce steel rails on the Grand Trunk (Canada) railroad. Some 15,000 tuns will be laid this year.

CURIOUS ICE FORMATIONS.

Our readers have doubtless read with much interest the communications upon this subject recently published in this journal, with illustrations of singular ice-spurs shooting from the surface of water frozen in ordinary open vessels, as also the accounts given of sudden formations of ice in dams and rivers. The study of these formations has an eminently practical bearing, and as we have received a somewhat extensive correspondence upon the subject, we will in the present article sum up such additional facts as have been communicated.

The theory of Mr. Wiegand has received a striking confirmation from a St. Louis correspondent, who writes us that in December, 1868, remaining in his office until very late at night, and the fire having gone out, so that the room became very cold, his attention was attracted by a singular crackling sound which he found to originate in the freezing of some water standing in a cold room adjoining.

Upon examination he found that an irregular hole had formed in the top of the layer of ice which rested upon the surface of the water, and that water was welling up through the hole. The water which issued from this embryo crater, spread about to a short distance, and almost instantly changed to ice. His curiosity having become excited, our correspondent continued to watch the phenomenon at intervals, until finally the walls of the crater had attained a considrable hight. The following morning he found it to be two and a half inches high, and three inches in diameter at the base, external measurement.

A correspondent from Lexington, Va., has made a mathematical calculation of the amount of water displaced during the freezing of a stratum of water one inch thick, in a pail ten inches in diameter, and finds that the displacement is not less than 7·85 cubic inches, or sufficient to form a cylindrical column more than six inches high, and one and one fourth inches in diameter. This correspondent, who is evidently a gentleman of much information upon this and similar subjects, indorses in substance the theory of Mr. Wiegand, in regard to the formation of ice in the dam at Week's Mills, Me., described by the Rev. W. H. Littlefield, in the correspondence above referred to. Its adherence to the wheel and gate, he ascribes to what is known as "regelation," a subject most ably discussed in Tyndall's lectures on heat. This term—regelation—may be defined as the adherence of fragments of ice to other fragments, when they are brought in contact with moistened surfaces, and also the freezing of ice to certain solids, such as wool, flannel, hair, cotton, etc., which freeze to ice even in a warm atmosphere. No adequate explanation of this phenomenon has yet been made, and it is spoken of by Miller as needing further elucidation.

Mr. Stanley G. Wight, formerly a member of the Board of Water Commissioners of the city of Detroit, has put us in possession of some interesting facts in regard to the formation and accumulation of ice in the strainer over the inlet pipe to the pump well in that city.

This strainer is nine feet in diameter, and is placed over and around the mouth end of the inlet pipe to the pump well. The inlet pipe extends into the river one hundred and fifty feet from the wharf, and its entire length is two hundred and twenty feet. On the river end of the pipe there is a bell-shaped mouth-elbow, covered by the strainer, and this was formerly surrounded by piles, driven to protect it from injury from the anchors of vessels.

Both pipe and strainer are made of half-inch boiler plate. Above the end of the pipe the strainer is perforated with half-inch holes, one hundred and forty-four to the square foot; and surrounding the mouth of the pipe, inside the strainer, there is a diaphragm plate similarly perforated. Below the diaphragm plate the strainer is perforated with four-inch holes, to allow the escape of sand. The piles surrounding the strainer are thirty in number, and the pipe is similarly protected by piles driven along its sides with masonry intervening.

The sixteenth annual report of the Water Commissioners sets forth that "under certain circumstances, during extreme cold weather, it is with difficulty a supply of water can be obtained, in consequence of the accumulation of ice on the strainer, frequently requiring the speed of the engine to be reduced, and at times to stop it for several hours together, no water passing through the pipe into the well, notwithstanding the bottom of the well is twelve feet below the surface of the river. The size of the well is about forty feet long, eighteen feet wide, and twelve feet deep. The circumstances under which the difficulty occurs are, when the weather is cold and ice is forming in the lake above and on the shores of the river, and the river is free from ice over the strainer. But when the river is covered with ice over the strainer, the difficulty does not occur at any degree of cold. The greatest difficulty occurs when the thermometer ranges from seven or eight degrees to eighteen or twenty degrees above zero, but when the mercury rises above twenty degrees the difficulty soon ceases. The greatest number of detentions, it has been observed, occur at night, and when the sun is obscured by clouds; but when the sun is unclouded, no difficulty is ever experienced. This peculiar stoppage to the flow of water to the pump well has been encountered for many years—first on the strainer of the inlet pipe laid in 1840, again on the one laid in 1850; both of which were located so near the wharf that the ice which formed on them was removed by means of long poles kept at hand for the purpose."

The report further sets forth, in substance, that with the pipe laid in 1858, which extends out further into the river than the former ones, the ice could not be removed as above stated, and all that was done up to 1866, was to wait for the ice to loosen without artificial appliances. The Board of Commissioners meanwhile were subjected to great anxiety, and at last it was referred to the Committee on the Supply of Water, consisting of Mr. S. G. Wight and Mr. J. Owen, who set about investigations into the causes of the difficulty, and the application, if possible, of some adequate remedy.

Every possible means was tried to gain information. A voluminous correspondence with scientific men and scientific associations failed to discover any complete remedy. With a view to test whether the trouble arose from anchor ice, as commonly supposed, a self-acting door was placed on the down-stream side of the strainer, which under similar circumstances had formerly afforded a limited supply of water. Certain unforseen causes forced the abandonment of this door.

It having been observed that no trouble arose when the river was covered with ice, booms were so placed that a sheet of ice should form over, and extend to some distance from the strainer, when the rest of the river was not so covered; this plan entirely failed. A platform of plank submerged immediately over the strainer on the supposition that it would act as a non-radiator, only increased the difficulty, the ice forming at higher temperatures than before.

On the 29th of December, 1867, while only a small amount of water was supplied to the pump well, a diver was sent down, who found the strainer one mass of ice, the particles being collected into a mound ten feet high and fifteen feet in diameter, and rapidly growing by the accumulation of minute ice crystals. Specimens of this ice brought to the surface showed it to be "*in sheets and particles as thin as paper, translucent, with sharp pointed edges.*" Further, it was found that all the water entering the pipe was through the down-stream side of the strainer.

It was now supposed that to inclose the strainer with a canvas screen on all sides of the surrounding piles except the down-stream side, would remedy the difficulty. This was only just accomplished when the weather became colder, and before daylight the next morning the engine stopped altogether. At 11½ o'clock the same morning, another descent was made by the diver, and it was ascertained that "with the temperature of atmosphere at *twenty-nine degrees*, the the water at the surface was *thirty-three degrees*, while at the bottom of the river it was *thirty-five degrees*. At this descent much less ice was found on the strainer and its surroundings than the first time. The lower side was clear, but on the upper side the action of the current had worn the ice into elongated cones, pointing up stream. At this time the pump was receiving a full supply of water."

The observations of the committee have established the fact that the ice particles described are constantly present in the river under certain circumstances, and that they collect upon any obstruction they meet with in their passage.

These facts are of great practical interest, and the conclusion is legitimate that much in regard to the formation of ice under peculiar circumstances remains yet to be explained. The subject is one on which a great deal can be said, and many curious facts can be elicited; and it is to be hoped that some scientist competent to grapple with it, will ere long penetrate deeper into the mysteries of ice formations than any one has yet done.

AWARD OF OUR CASH PRIZES.

We announced in our annual prospectus, for 1870, that we would distribute $1,500 in cash prizes in competition for the fifteen largest lists of subscribers sent in on or before the 10th of February. We also announced the offering of a splendid steel engraving, as a certain reward for clubs of ten names and upward, obtained at our published rates. The interest manifested in the engraving has been spirited and satisfactory. Already hundreds of copies have been sent to those entitled to receive them, and many recipients have written to us in praise of the picture as a work of artistic merit.

This has been a pleasant, and, on the whole, a very agreeable feature of our programme; but in reference to the matter of the cash prizes, which to many, doubtless, appeared to be more difficult to obtain, only eight persons announced themselves as competitors, and as a matter of course each has won a prize. The result is not so agreeable to us in a financial point of view as the prize picture. Still we shall cheerfully respond to and honor the drafts drawn upon us by the following named gentlemen for the sums set opposite to their names, and at the same time we congratulate each of them upon his success.

To J. W. Briggs, West Macedon, N. Y.	$300
" M. Moody, Dennison, Ohio	250
" James C. Wells, Warren, Pa.	200
" W. A. Knight, East St. Louis, Ill.	150
" G. F. Merriam, Fitchburg, Mass.	100
" P. H. Wait, Sandy Hill, N. Y.	90
" G. W. Rose, New Bloomington, Ohio.	80
" W. C. Rusheneker, Atchison, Kansas	70

With the above result before us, we announce our retirement from the cash prize business, but shall continue to award the engraving as a premium to clubs, as per our published rates. As a work of art it has received unqualified praise.

M. GAUDIN has lately exhibited some excellent imitations of precious stones, the basis of which is alumina fused with silica by means of the oxy-hydrogen blowpipe. He uses metallic oxide to give them the proper color. It is also stated that a pupil of Liebig has made some discoveries in the same direction; but as yet his method is not definitely given.

THE Superintendent of the Brooklyn Bridge Company thinks it will take five years to complete the bridge. The machinery for the construction of the towers will cost $150,000.

Food for Trout in Fish Ponds.

From the Third Report of the Commissioner of Fisheries of the State of Maine, we extract the following in reference to food for trout:

"Rearing fish in small private ponds, where they must be altogether fed by hand, will answer very well when confined to the maintenance of the young, through the early stages of growth, when they would be most liable to destruction if turned loose, or to the growing of a limited number of breeding trout or fresh-water salmon. But when it comes to raising fish for the table, such management does not promise to produce cheap food for man unless there be found some source of food for the fishes that shall be cheaper than any that has yet been proved. It may be as easy to raise trout as to raise chickens or pigs; but in order to furnish them as cheaply to the market, they must be grown on food as cheap as that which grows chickens and pigs. Now trout are carniverous—so are all other fishes with whose habits we are acquainted. To be sure, many kinds will eat vegetable substances, bread, corn, rice, and so on, and it is quite probable that these matters contribute to their nourishment; but whether there be any species that is mainly a vegetarian is a matter of doubt. Even gold-fish are found to grow sickly if deprived for a long time of animal food. But animal food is expensive, at least that which is to be had in the markets; and as to butcher's refuse, the necessity of obtaining during warm weather a fresh supply almost daily would greatly increase the expense. Besides, a tolerable approach to economy in the use of meats, which is sure to take place with the increase of population, and the consequent demand would so far utilize many parts of slaughtered animals that now go to waste, that the residue would hardly be equal to any great demand from fish growers. The food that has generally been used for trout is liver. Some calculations regarding the profitableness of raising trout have been based on the supposition that liver can be obtained at three or four cents a pound, and at this price it may be that trout can be reared and marketed at a profit, but they certainly would not be *cheap*, and probably would be only luxuries. Yet parties engaged in trout-growing in Massachusetts have been paying, during the past season, for beef's liver, to feed their young fry, *ten cents a pound*, a price, which, if the liver were fed to the larger fish, 'would be ruinous.' Curdled milk has been used by some with favorable results; and should this be found on full trial to meet all the wants of the fish, it must take the place of liver and such meats. One company, located at West Barnstable, Mass., feeds the large trout on salt water shrimps, gathered in the marshes in the immediate vicinity, and costing one dollar per bushel. Should all these plans fail, it is yet believed that some way will be discovered of utilizing the insects that devour our crops, or the flies that breed in offal and about stables and manure heaps.

"A bare statement of the number of persons engaged in this industry will show that it is no longer regarded in the light of an experiment. In New England and the Middle States, there are probably thirty or forty establishments for the cultivation of fish, principally trout, with a view to profit. One firm in Western New York hatches several hundred thousand trout annually, and has realized as much as $10.-000 profit in a single year. These profits, however, be it bore in mind, are mainly from the sale of young fish and fecundated eggs."

NEW BOOKS AND PUBLICATIONS.

HAND-BOOK FOR THE ARTISAN, MECHANIC, AND ENGINEER. Comprising the Grinding and Sharpening of Cutting Tools, Abrasive Processes, Lapidary Work, Gem and Glass Engraving, Varnishing and Lacquering, Apparatus, Materials, and Processes for Grinding and Polishing, etc., etc. By Oliver Byrne, Civil, Military, and Mechanical Engineer, author of "The Practical Metal Worker's Assistant," "The Practical Model Calculator," "Elements of Mechanics," etc., etc. Illustrated by one hundred and eighty-five Wood Engravings. Philadelphia: Henry Carey Baird, Industrial Publisher, No. 406 Walnut street. Price, by mail, free of postage, $5·00.

While this work is a guide to the accomplished and finished artisan, the descriptions of processes and directions for procedure in the various departments of handiwork, of which the work specially treats, are of the plainest and most practical character. The author states in his preface, that the intention has been to make these directions so profuse and minute, that any mechanic or amateur following them strictly may succeed at the first attempt in performing any operation described. As will be seen by the title the work covers a large field, much of it a *terra incognita* to the majority of American mechanics. Among subjects little understood in this country, and upon which the work treats at large, are lapidary work and the performance of such ornamental work, now mostly done in Europe, as is perfected by the use of abrasive materials. Particular attention is paid to the finishing of various kinds of work, and the general information given is so diffuse and profuse, that scarcely any workman in any branch of industry will not find the book eminently serviceable to him. The author is already widely and favorably known through his previous works, it is praise enough of the present work to say that to the practical mechanic, it exceeds in value anything Mr. Byrne has yet written.

A HAND-BOOK OF PRACTICAL TELEGRAPHY. By R. S. Culley, Engineer to the Electric and International Telegraph Company. Published with the sanction of the Chairman and Directors of the Electric and International Telegraph Company, and Adopted by the Department of Telegraphs for India. Fourth Edition, Revised and Enlarged. New York: D. Van Nostrand, Publisher, 23 Murray street, and 27 Warren street.

The contents of this work are included in the following classification: The Electrical Laws upon which the System depends; the Methods of Discovering Faults; the Practical Management of Apparatus; the Construction of a Line; and the Leading Principles of Submarine Telegraphy. The author has had the assistance and co-operation of some of the most able English electricians in obtaining information, and the work contains full descriptions of the latest improvements. The first thing which impresses us in an examination of this work is the great skill with which, without burdening the text with technical terms, the author has been able to make his discussions complete and reliable, and at the same time attractive, from their terseness and perspicuity. The style is admirable; and it would seem that even the most unscientific ought to be able to read the work with ease and satisfaction. The scientific reader will, however find, that while the work is eminently practical, it has a foundation of sound theory, and its pages contain enough to make it a valuable addition to any library of technical works. We will, in a future issue, make an extract or two from the work, from which our readers may judge the better of the author's style and method.

IRON TRUSS BRIDGES FOR RAILROADS. Methods of Calculating Strains, with a Comparison of the most prominent Truss Bridges, and New Formulas for Bridge Computations. Also, the Economical Angles for Struts and Ties By Brevet-Colonel William E. Merrill, U. S. A., Major-Corps of Engineers. New York: D. Van Nostrand, 23 Murray street and 27 Warren street.

Bridges are the most costly, and, as a rule, the worst constructed features of American railroads. While there are splendid and honorable exceptions to this rule, all the more brilliant from contrast with the rude and ill-composed structures which so often shock the artistic sense of those who possess taste, and expose their lives to great risks in common with those who have no taste, the fact remains that the majority of railroad bridges erected in this country are—to draw it exceedingly mild—little credit to American engineering. The work before us is an attempt to give a basis for sound reform in this feature of railroad engineering by throwing "additional light upon the method of calculating the maxima strains that can come upon any part of a bridge truss, and upon the manner of proportioning each part, so that it shall be as strong relatively to its own strains as any other part, and so that the entire bridge may be strong enough to sustain several times as great strains as the greatest that come upon it in actual use." The various trusses examined are the Fink, Bollman, Jones or Howe, Murphy-Whipple or reversed Howe, Post, Triangular, and the Linville or Pratt. It is premised that safe bridges can be built on any one of these plans, but that some require more metal than others in order to secure the requisite strength. These various forms are discussed at length, and a large number of valuable new formulas are deduced from those of Hodgkinson, calculated to be of great service to engineers in the solution of the various problems relating to bridge construction. The work is published in excellent style and in quarto form, and seems to have been carefully edited. It is illustrated by plain and colored diagrams.

MCKILLOP, SPRAGUE & CO.'S COMMERCIAL REGISTER FOR 1870.

The above well-known leading commercial agency, formerly of 37 Park Row, has issued from its new and capacious buildings, 109 and 111 Worth street, one door east of Broadway, New York, its Commercial Register for 1870. During the past year changes have been much more numerous than in previous years, and the list of names has reached to the astonishing number of some five hundred thousand. The business history and antecedents of the individuals included in this list have been obtained with great care, and must have necessitated a very large expenditure. The reputation of this agency for accuracy is an enviable one, and we find that in consulting it for the business standing of persons in various parts of the country whose business standing we personally know, the ratings are verified by our knowledge of their character. The Southern States are reported much more fully than last year. Another indication of the increasing prosperity of that section. Changes and new firms will be noticed as they occur in a weekly circular issued to subscribers. Messrs. McKillop Sprague & Co. are constantly extending their facilities, and will continue to extend them as may be required to protect the interests of their patrons. No business firm who extends credit to their customers can afford to be without this annual register. Manufacturers can get the names and address of nearly every person in the United States using the articles they make. See advertisement on back page of this paper.

THE February number of the "Aldine Press," published by Sutton Bowne & Co., 23 Liberty street, New York city, is the most beautiful specimen of typographical perfection we have ever seen in a periodical. It is printed on beautiful cream laid paper, and contains, besides a choice literary repast from the pens of various popular authors, two magnificent engravings from Doré and five others from artists of distinction. This unsurpassed "Typographical Art Journal" is published monthly at the low rate of $2·00 per annum.

WE are in receipt of "Self-Instructing Drawing Lessons for Little Folks," published by John D. T. Brooks, 20 Washington street, Boston, Mass. The studies are judiciously selected, and are arranged in progressive order. We recommend the work as being well adapted for the intended purpose. It might be continued in numbers with profit to the little folks.

THE PHOTOGRAPHER'S ALMANAC, for 1870, edited by A. H. Wall, and published at the office of the "Illustrated Photographer," London, is one of the most beautiful and comprehensive annuals relating to the heliographic art that has come under our notice. It contains a large amount of interesting and valuable information, embracing all the best recipes and new processes in photography that have been made public during the year.

THE ARCHITECTURAL REVIEW AND AMERICAN BUILDERS' JOURNAL, for February, is one of the best numbers we have yet seen of that excellent periodical.

Recent American and Foreign Patents.

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

WASHER AND WRINGER.—D'Alembert T. Gale, Poughkeepsie, N. Y.—The object of this invention is to construct a convenient apparatus which can be used both for washing and wringing garments, and which is of very simple arrangement, and easily manipulated.

KEYS FOR LOCKS.—Joseph Linder, Seneca Falls, N. Y.—This invention relates to a new key for door and other locks, and consists in the application to the key of a pivoted plate, carrying a concealed bit, which allows the key to be introduced through a circular keyhole, the bit being forced out for action by the introduction of the key into the lock.

PAY BOX.—W. W. Wormood, Dubuque, Iowa.—The invention consists in an improved arrangement for discharging the fares from the first receptacle and depositing and securing them in the space below, as is required to keep the said first receptacle clear for the better inspection of the fares as they are deposited, and to permit access thereto by the conductor.

VELOCIPEDE.—G. D. Emerson, Calumet, Mich.—This invention relates to improvements i velocipedes, and has for its object to provide a propelling arrangement whereby the operator may apply the whole force of his weight to the work ordinarily, and, at times, an additional force by adding the force of his arms to the effect of his weight.

SHEET MUSIC HOLDER AND TURNER.—F. J. Herpers and M. M. Sommer, Newark, N. J.—This invention relates to improvements in an apparatus to facilitate the holding and turning of the music sheets by the performer so as not to interrupt the playing, and it consists in the application, to any music sheet-holder, of spring-actuated turning arms, arranged to be held by a button and to throw the sheet over when let go, and provided with a ratchet and spring pawl, by which the operator may instantly disconnect one arm at a time by a touch of the pawl. The invention also comprises an improved spring clamping attachment for connecting the holder to the stand.

JOURNAL BOX.—James T. Robinett, Petersburg, Va.—The improvement relates to the manner in which the bearing piece and its lining are united together, referring to that class of journal boxes which are made in two parts.

KNITTING MACHINE.—Henry V. Hartz and Julius Feiss, Cleveland, Ohio—The object of this invention is to simplify and improve the operation of the knitting machine, making it more convenient and easy to control while it operates more rapidly, accurately, and effectually, and with less breakage of the yarn, and makes better work.

BUCK SAW FRAME.—Thomas H. Rollins, Detroit, Me.—The object of this invention is to provide means for straining wood or buck saws in thin frames by lever purchase, and to so connect the cross bar with the stands that the stands shall not be weakened by cutting mortises therein.

SUSPENSION BRIDGE.—Jarvis Royal, White Rock, Ill.—This invention relates to new and useful improvements in suspension bridges, whereby the construction of that class of bridges is greatly simplified, and the invention consists in making the suspension cable in sections and in the method of fastening the same, and also in the method of forming and supporting the road bed.

GAS-BURNING SAD IRONS.—Robert Drake, Newark, N. J.—This invention relates to new and useful improvements in sad irons, which are heated by the combustion of gas therein, and consists in the peculiar mode of introducing the gas into the interior, and in the formation of the interior of the bottom or face of the sad iron, and in the devices in combination therewith for insuring a perfect flow and combustion of the gas.

HORSE POWER.—C. H. Gifford, Potsdam Junction, N. Y.—This invention relates to a new and useful improvement in horse-powers for driving thrashing machines and other machinery, and for all purposes to which it is applicable.

ANTI-FRICTION JOURNAL BEARING.—R. G. Hatfield, New York city.—This invention relates to a new and useful improvement in journal bearings, whereby the journal is relieved of frictional or rubbing contact, and revolves on a moving surface; and the invention consists in a revolving ring (upon which the journal rests) supported by a series of friction rolls in a revolving frame.

VEHICLE SPRINGS.—John Goller, Los Angelos, Cal.—This invention relates to improvements in springs for thorough brace vehicles, and consists in the construction of bow springs for attachment to the ends of the bars of the reach frame and the straps or bows of alternate leaves of steel and wood, and in bending the outer steel leaf around the upper end of the other leaves, forming, in connection with a band or metal socket, a recess in which the ends of the wood and inner metal leaves are allowed to work, to compensate for the expansion and contraction due to the springing action, the said space being filled with an india-rubber spring against which the ends of the said inner leaves work.

GANG PLOW.—John Cox and Solomon Cox, Eugene City, Oregon.—This invention relates to a new gang plow which is adjustable in every direction, and of simple and desirable construction. The invention consists in the general arrangement of the adjusting devices and of various details of construction.

FLOORING FOR HOUSES.—Wm. Baum, Hoboken, N. J.—This invention has for its object to construct a wooden floor for rooms, halls, etc., which can be made of broad boards and without the use of nails, and which will not be liable to warp or expand. The invention consists in the use of grooved and tongued rails attached respectively to the beams and to the undersides of the boards. These rails lock the boards at several places firmly to the beams and prevent effectually every displacement of the same.

TRUNK LOCK AND HASP.—E ward L. Gaylord, Terryville, Conn.—This invention has for its object to improve the construction of hasp locks and hasps, so as to make them stronger, more convenient, and more ornamental than when constructed in the ordinary manner.

ADDING MACHINE.—Gilbert W. Chapin, Brooklyn, N. Y.—This invention has for its object to furnish a simple and convenient adding machine, designed more particularly for bookkeepers' use, and which will enable the user to add columns of figures with quickness and accuracy.

WATER VELOCIPEDE.—Oliver A. Davis, Brooklyn, N. Y.—This invention has for its object to combine with a small and light boat an arrangement of mechanism by means of which the boat may be easily and rapidly propelled through the water by a convenient application of foot power.

GRATE.—G. H. McElevey, New Castle, Pa.—This invention has for its object to improve the construction grates for fireplaces and stoves, so that a draft may be introduced into the rear side of the fire, and introduced in such a way that it may be controlled as may be desired.

COMBINED CLOTHES WASHER AND DRYER.—Edwin Rees, Stoddartville, Pa.—This invention has for its object to furnish a simple, convenient, and effective machine for heating the water, washing, rinsing, and drying the clothes, and which shall, at the same time, be very compact, taking up but little room.

HOISTING APPARATUS.—Matthew Lynch, New York city.—This invention has for its object to furnish a simple, convenient, reliable, and safe hoisting apparatus, designed more particularly for use upon the outside of school and other building, but also applicable for use in other situations, and which shall be so constructed that it may be stopped and will remain stationary at any desired elevation.

ADJUSTABLE DRAFT BAR.—L. S. Clarke, Bethel, Conn.—The object of this invention is to provide for a difficulty which has always been experienced in arranging thills to one horse sleighs or cutters, and other one-horse vehicles, so that the horse may travel either in the middle of the road track or upon one side, at the pleasure of the driver.

NEEDLE WRAPPER.—Alfred Shrimpton, Redditch, England.—This invention consists in fitting the needles to be prepared through the folded edges of a compound piece or strip of paper and fabric, and attaching the edges of the paper of the said compound piece or strip to the paper wrapper.

PIN FOR ARTIFICIAL TEETH.—H. M. Raynor, New York city.—This invention relates to a new manner of constructing the pins by which the teeth are fastened to the rubber or base, and consists of making these pins of wire, doubled up in such manner as to form loops at the projecting part, the ends of the wire being imbedded in the teeth.

ROTARY PROVISION SAFE.—Austin Sly and Samuel S. Ford, Lebanon, N. H.—This invention has for its object to construct an airy, convenient provision safe which cannot be entered by rats, mice, or insects, and which will at all times remain clean and in good order.

FEED WATER HEATER.—Enos B. Johnson, Chicago, Ill.—This invention relates to a new apparatus for heating the feed water of steam boilers by means of the exhaust steam for the purpose of utilizing the heat of the exhaust. The invention consists in the general arrangement in a water chest of detaining shelves and serpentine steam pipes, all combined in such manner that the water ascending in the box will by the shelves be caused take a circuitous course following the windings of the steam pipe, while the steam entering from above passes through the water and gives off its heat to the same.

DENTIST'S ARTICTLATOR.—G. F. Schaffer, New York city.—The object of this invention is to provide a convenient "joint" for dentist's articulators, which will prevent the two parts of the same from being brought closer together than is necessary.

CARRIAGE TOP.—William Schoch, Plumsteadville, Pa.—This invention consists in the application to a carriage top, of a removable jointed fly or "shoot" which can, when not used, be taken off, the top folded together and packed away under a seat or in any other desired place.

CAR COUPLING.—Robt. Green, Boonton, N. J.—This invention relates to improvements in self-coupling car couplings, and consists in the combination with a hollow funnel-mouthed draw-head, provided with a broad, longitudinal opening through the top to the hollow space, and a shoulder or ledge at the neck of the funnel-shaped mouth, of a swinging catch-plate arranged in the said opening through the top, to swing up and down on the rear end engaging with the rear wall of the draw-head; the under side of the said plate being provided with a shoulder or ledge to act in conjunction with the shoulder at the neck of the draw-head, to hold the head of the shackle or connecting link, which, when forced in, will raise the swinging plate and pass beyond the shoulders, when the plate will fall and hold the shackle.

SPLITTING ROCK.—John Robb, New York city.—This invention consists in filling or nearly filling the holes drilled in the same way as for blasting, with water, or other liquids, and then inserting plungers fitted to work as tightly as possible, above the water, and subjecting the said plungers to the action of great weights, hammers, or other devices let fall upon them, or otherwise imparting great concussive force, which is, through the medium of the water, expended upon the side walls of the holes in the direction best calculated for separating the rocks.