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IMPROVED STONE-SAWING MACHINERY.

Since the discovery of the bort carbon, or black diamond, much skill and a vast amount of energy and capital have been expended to render it of practical value to manufacturing industries. It has long been known to scientists as one of the hardest substances in Nature; and it has been, and is still, used by lapidaries in cutting and polishing other precious stones, even the white diamond. It has also given aid to industrial science in improving the diamond drill, and more recently to the mechanic arts, in giving us new cutting tools for use on substances on which iron and steel were useless. But while its value for cutting hard substances, especially stones of various texture and density, has been known and appreciated, its practical utility has been impaired by a difficulty in harnessing it, that is, holding it securely for effective use. A large amount of inventive skill, time, and money has been expended in the attempt to accomplish this, with more or less success; but the attempts were generally entire failures, especially the attempts to saw and work stone The records of the Patent Office, within the last ten years, show the various modes and appliances to this end; and the invention of Mr. Branch has been one of the most practical successes among all such machines

The circular saw, taking into consideration its unlimited capacity in sawing lumber, was considered by most inventors as the one to which the diamond could best be applied for sawing stone. Mr. Branch's first patent, dated June 8, 1869, was for the insertion of the diamond into a steel or iron holder made in two parts, with recesses for the diamond, and provided with soft metal cushions for the diamond to rest in. These holders were then dovetailed into the edge of the saw disk, and compressed, by a wedging device, the diamond into the soft metal. This saw was a success so far as the cutting was concerned, but the diamond could not be held securely for practical work, and the project was abandoned. Others have attempted improvements on this by brazing the diamonds into iron or steel holders; but the results were no better. The soft metal cushions would yield to the pressure of the work, and the centrifugal velocity of the saw would throw the diamond away. Some inventors, seeing these apparently unconquerable difficulties, regarded the circular saw as impracticable; and attempts were made to apply the diamond teeth to the sash or reciprocating saw, claiming for it greater capacity in the sawing of large blocks. While this merit may be conceded to a limited extent, the reciprocating saw is not equal to the circular saw, either in quantity or quality of work performed; while the risk of losing the diamond was in no wise lessened, except by the use of a sieve or cage to catch the recreant diamond, so that it might be again reset, to be again, as before, thrown out.

Mr. J. W. Branch, the inventor of the machine herewith illustrated, claims to have achieved the secure holding of the diamond in steel or iron holders, without the dubious aid of soft metals, and his Stone Monarch, as he calls this sawing machine, gives the circular saw the same prominence in relation to the stone-working industry as in that of wood-working.

The peculiar manner of inserting the diamond into holders, and these holders into the saw disks, is fully described in letters patent dated August 31, 1875; and the chief merit of this invention is the perfect security given to the diamond under any velocity whatever. The diamond holders are simple in construction (Fig. 2), and are furnished either in the saws completed, or in duplicate, so that any that may become faulty, by undue pressure or otherwise, may be renewed or replaced. They can be inserted into the saw by any practical mechanic, if the saw in other respects be perfect, without his having the skill to set the diamond.

The mode of applying water for lubricating the saws in work, and washing away the grit and dirt, is novel, and is peculiar to these machines. The water is conducted through the center of the mandrel into chambers, and through radial orifices, A, in the saw collars on each side of the saw, causing the water to impinge upon the saw blade, and to be, by the centrifugal force, conducted to the cut. This effects three results: 1. Keeping the journals of the mandrel cool. 2. Keeping the saw cool and even in temperature, preventing all undue expansion. 3. Cleansing the saw from all grit and dirt produced in sawing.

The machinery for conveying the stone is perfectly under the control of the attendant, and is provided with a simple feeding device, adjustable to accommodate the variable texture or density of the stone to be sawn. The saws are also made adjustable relatively to the depth of cut, either entirely or partially through the block, preserving a straight line at the bottom of the cut, but allowing for moldings, rebates, etc.

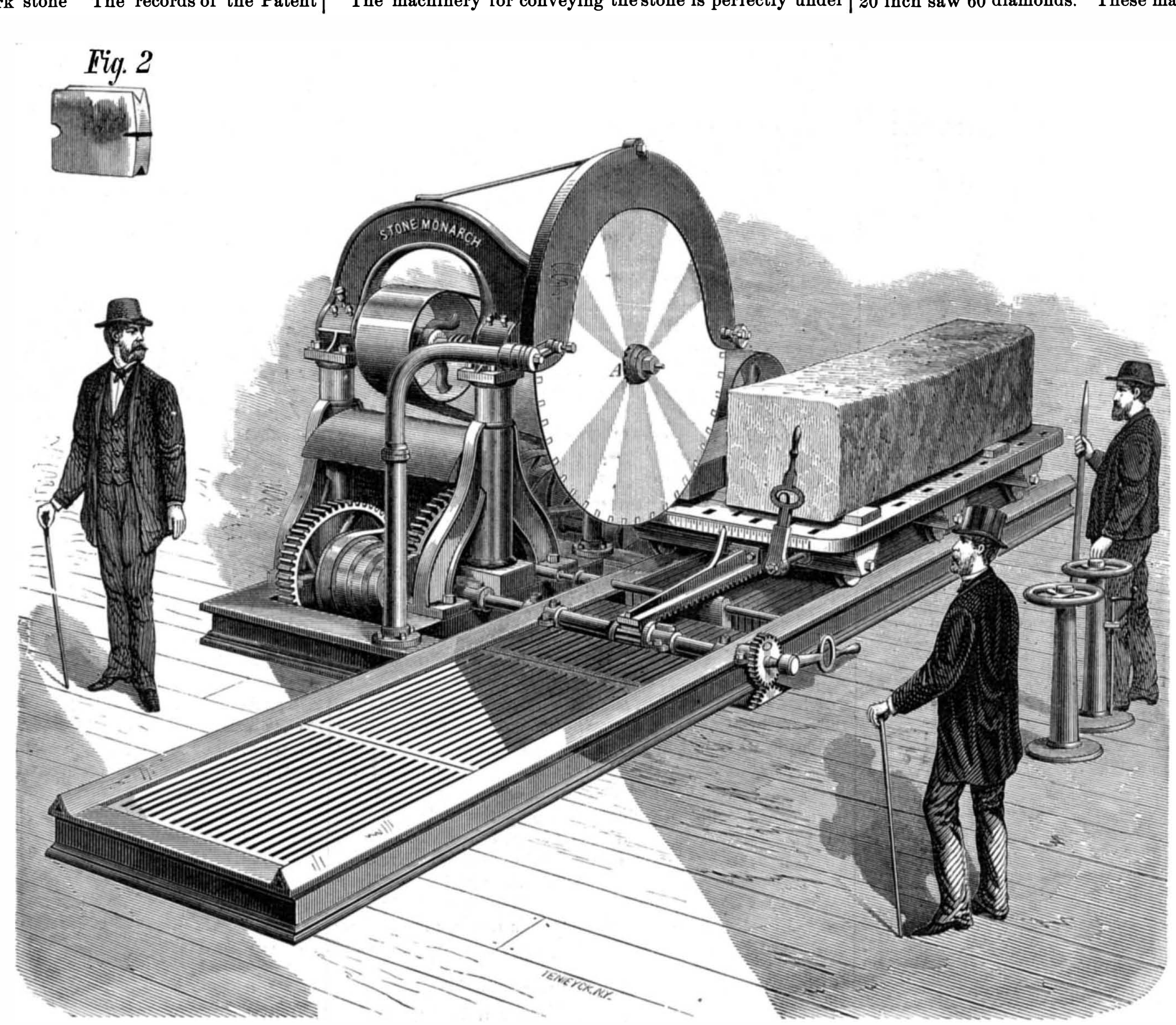
The table to carry the stone is placed on a series of rollers set in the carriage, which provides for the easy adjustment of the stone at right angles with the saw, so as to cut off any thickness required. The carriages upon which the table is placed is also provided with rollers, fitted upon parallel V ways, and with a feed rack working upon a feed pinion.

It will be observed that there are no slides, and that the roller bearings and journals are all covered, so that the working parts are not impaired by any accumulation of grit or dirt. The saws are used either over or under the work, but preferably over for sawing large blocks and ashlar, and under for edging, crosscutting, and sawing small dimension stone. This range of use is due to the central application of water; as, by the centrifugal velocity of the saw, the water is always conveyed to the cut. In short, these machines are adapted to meet all the requirements of straight line work, without complication; and a large proportion of work required for building can be finished, ready for erection, without the aid of the rubber or hand labor. The saws, moreover, run at the periphery at an average velocity of 10,000 feet per minute, which effects great rapidity and perfection in cutting stone: the difference being due to the variable density of the stone to be cut, varying from 1 to 36 inches per minute, or per 10,000 feet run of the saw. The ordinary freestones and sandstones are sawn by these machines at the rate of from 6 to 36 inches per minute, and marble and limestones at from 3 to 18 inches per minute, or an average from 200 to 800 feet per day, making due allowance for handling of stone.

The manufacturers, Messrs. Branch, Crookes & Co., have on exhibition at the Centennial (section A 16 and 17, saw mill), two of their diamond circular saw stone machines, with the necessary traveling crane and facilities for handling stone. The two machines have 66 and 20 inch saws respectively. The 66 inch saw contains 84 diamonds, and the 20 inch saw 60 diamonds. These machines are kept in operation, practically illustrating what we have already described; and they attract a great deal of attention from visitors to the Exhibition.

Patented to Joseph W. Branch, under dates June 8, 1869, May 27, 1873, and August 31, 1875. For further particulars and for descriptive circulars, address Branch, Crookes & Co., 114 and 116 Vine street, St. Louis, Mo.

Fig. 2



BRANCH'S DIAMOND STONE-SAWING MACHINE

Melon Sugar.

Andros Island, in the long delta between the rivers Sacramento and San Joaquin, California, belongs to a group of low islands that are submerged at high water, and therefore not fit for culture. But when reclaimed by embankments they are exceptionally productive Melons are a crop that never fails in this climate, and the factory on Andros Island can get melon juice from a vast area of melon country at small expense for transport. Water melons with white pulp are preferred. They are planted twelve feet apart one way, and the other way six feet apart. The leaves of the plants cover the ground and kill the weeds before they interfere. Besides, they make an impenetrable mulching, which keeps the soil moist and prevents baking. The melon juice is free from impurities, which make chemistry costly in beet sugar, is much less expensive, and the sirup is delicious. The seeds make oil, and the refuse is good for cattle. Taking account of so many advantages, sugar from melons, though rated at 7 per cent of the weight of the fruit, instead of 8 per cent allowed for beets, costs less to make. The difference may be set down as 5½ cents for melon sugar to 7 cents a pound for beet sugar. In regard to quality, melon sugar is superior. Unless extra care be used, beet sugar is apt to have an unpleasant buggy flavor.

Let it be understood that beets can only succeed in moist, bottom lands. Melons strike deep root, and they grow everywhere on our uplands. No doubt they would thrive luxuriantly in Jersey, Delaware, and Maryland. In the sandy soil of States South, no crop can be more certain, and Baltimore would make a convenient center for supplies of melon sugar works. Our California correspondent states that San Francisco sympathises with Baltimore, and will keep her advised as to the success of the melon sugar-making industry.—*Baltimore Sun.*

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Contents.

(Illustra.ed articles are marked with an asterisk.)

THE SCIENTIFIC AMERICAN SUPPLEMENT.
Vol. II., No. 39.
For the Week ending September 23, 1876.
With 40 Illustrations.

TWO PERSONALITIES IN ONE PERSON.

The record books of the medical profession contain not a few reports of patients living double lives: cases in which there is a periodical loss of one phase of mental life and the assumption or resumption of another very different one. For example, an hysterical subject will have a fit, and on coming out of it will be found to have lost all memory of the past. The mental faculties remain unimpaired, but so far as knowledge goes the patient's mind is that of an infant. With more or less delay she will learn to talk, and to read and work, practically beginning life again at the beginning, and sometimes developing a character quite unlike her first one. The physical basis appears to be the same; but the personality is entirely different, with different temperament, different habits, different tastes, and so on.

Matters will continue after this fashion for an indefinite period; and then the patient will go into another fit, emerging just as she was originally. All the life she has lived since the first fit is suddenly wiped out. She can recal none of it; for the time her second life, and it may have lasted years, is annihilated, and the current of her original life flows on as serenely and naturally as if it had never been broken—until another fit sets her back to the end of her second life, which she takes up again in utter unconsciousness of a break in it. And so her existence alternates between two lives entirely distinct and independent of each other, save that the same body serves for both.

Formerly such alternations of consciousness were explained by spiritual or demoniac possession. The body was supposed to be tenanted by two independent spirits; or the patient's soul was from time to time ousted by some other malignant or benevolent soul, as the tempter might indicate. In our more scientific and materialistic days, the spiritual hypothesis has few retainers: the phenomena in question being much more satisfactorily explanable by supposing that the patient's mental life has been carried on wholly or chiefly by one side of her double brain, and that, when the action of that side is arrested by disease, the unused side takes up the intellectual function and continues until another paroxysm shifts the responsibility to the first used side. So the two lives alternate with the alternating functional activity of the two brains: the reason that such lives are always double and never triple or manifold lying in the fact that we have only two independent brain lobes and no more.

The latest case reported of this sort is exceedingly interesting, and peculiar in that there is a loss of continuity in the life only when the state recurs in which the patient's life began. The case is reported at length in the *Revue Scientifique*, by Professor Azam, of Bordeaux, where the patient lives. The patient is a married woman, now about thirty-four years old, and has been living a double life since she was fourteen years old. For brevity, we will call her first state of consciousness and its repetitions, A, and the second state and repetitions, B.

At first B came on at intervals of days, and lasted for a few hours only. Twice it was absent for three years at a time, from the age of $17\frac{1}{2}$ to $20\frac{1}{2}$, and again from 24 to 27. Latterly she has lived the life of B most of the time, A recurring at intervals of two or three months, and remaining but for a few hours. Formerly the transition occurred during some minutes of unconscious sleep following violent pain in the temples; now it is almost instantaneous. In A, the patient has always been quiescent and somewhat morose in disposition; in B, she has always been bright, gay, and affectionate. In A, she has no memory of events which happen in B; but in B, she has a full recollection of her life in both states—a remarkable peculiarity in her case, as already observed. In B, her distress, on discovering that there have been blanks in her conscious experience, is extreme; but the practical inconvenience of such loss of memory, formerly great, has become less with the predominance of B. On rare occasions on passing out of B, the patient suffers a brief period of agitation and extreme terror, during which her knowledge is somewhat disordered; at other times there is no apparent derangement except such as commonly appears in hysterical patients.

In her passage from B to A (Professor Azam remarks), she does not emerge from a dream, for a dream, however incoherent, is always something. She emerges from nothing. The time elapsed may be an hour, or it may be months, it is all the same to her; an entire section of her conscious life has dropped out. "To compare her existence to a book from which some pages have been torn is not enough. An intelligent reader might fill the blank, but she can have absolutely no notion of anything that happened in her secondary state."

A world of curious problems and complications, social, theological, and other, are suggested by such a case as this. Fancy a person on trial for a crime committed in a previous state of which no recollection remains, with no one aware of the criminal's peculiarity: or a woman to find herself suddenly (to her) surrounded by a family of children, owning her as a mother, yet utterly unknown to her! There is a splendid chance for a sensational novelist. And we should like to hear a convention of clergymen discuss this proposition: Suppose a victim of double consciousness to be a saint in A, and a wretched sinner in B. Her earthly existence terminates in B. Will the two states of consciousness be united by the destruction of the conflicting organs of consciousness? Or will two souls remain, to go to their diverse ways? Again, if there is one, and only one, soul to survive, will it be damned for the sins of B, or saved by the faith that illuminated A?

THERMO-DIFFUSION---A NEW PHYSICAL PHENOMENON

It is a well known fact that gases dilate when heated, unless enclosed in space of invariable volume, in which case the action of the heat is manifested by an augmentation of pressure which increases with the temperature. If the space in which the gas is contained communicates with the air, the heat determines the escape of the gas through the orifice, more or less rapidly, but so that, at a certain instant, if the temperature remain constant, equilibrium will re-establish itself, at which time the pressure of the gas within will be precisely equal to the atmospheric pressure without.

This is easily verified in the following manner: In a block of any porous body (Fig. 1), plaster, for example, a cylindrical cavity is made, in which is introduced and fastened the extremity of an open tube, *a b*. The outer end of the tube communicates with a manometer. On the block being heated, equilibrium of pressure will maintained constant, the mercury remaining at a level in the branches of the instrument. A modification of this experiment may be made by substituting for the plaster block a vase of porous earth, such as is used in many galvanic batteries (Fig. 2), which is closed by a pierced cork, through which passes the tube, *a b*, connecting with the manometer; or instead of using the cork, the tube may be sealed in position by a little plaster. The vessel may remain empty or be filled with pulverulent material; and whatever the form of the apparatus, the results above described will always be the same, provided dry material be always used.

Fig. 1.

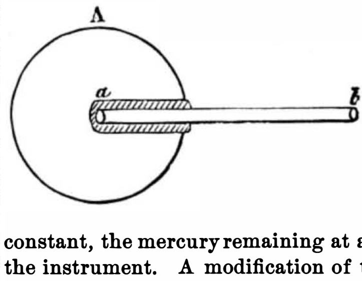
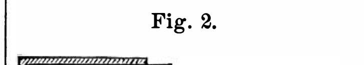


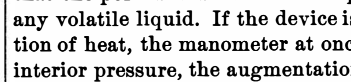
Fig. 2.



If, however, on the contrary, the material be moist, a new phenomenon presents itself, which, as *La Nature* states, M. Merget, of Lyons, has recently discovered, and to which he gives the name of "thermo-diffusion." This apparatus is the same as already described, with the difference, however, that the porous vase or block is previously saturated with any volatile liquid. If the device is then submitted to the action of heat, the manometer at once indicates a difference of interior pressure, the augmentation of which depends on the volatility of the liquid, and the temperature reached. By employing a thermo-diffuser, $4\frac{1}{2}$ inches long by $1\frac{1}{4}$ inches in diameter, the interior pressure at the limit of dark red heat has been caused to attain that of 3 atmospheres, or 45 lbs. per square inch. This exists as long as the liquid is not entirely evaporated, but ceases as soon as the evaporation is complete, the mercury at once returning to a level in the manometer, regardless of the temperature present. The conditions described as occurring in the dry vase then resume.

This novel phenomenon may be exhibited in still another way (Fig. 3). The manometer being disconnected from the tube, the end of the latter is plunged in water As soon as heat is applied, bubbles of gas are disengaged more or less rapidly. This disengagement is ultimately connected with the evaporation of the liquid, and is uniform as long as the evaporation continues regularly, but stops as soon as the latter terminates. M. Merget indicates, as follows, the conditions which determine variation in quantity of the gas given off. For similar thermo-diffusers, unequally moistened, the volume of gas disengaged varies with the proportion of water absorbed; and for different thermo-diffusers, wet to saturation, the volumes obtained have varied around an average of about 40 times the volume of the apparatus employed. The velocity of disengagement, which augments as the heat increases, depends on the extent of thermo-diffusive surface, and varies in like manner. It has reached several hundred cubic inches per minute with large porous battery vases.

Fig. 3.



M. Merget has likewise established that, in thermo-diffusion, it is the moist porous periphery which is the necessary condition of the phenomenon, and not the difference in hygrometric states of the gases. Two saturated thermo-diffusers were placed under entirely dissimilar conditions, one being located in a thoroughly dry exterior atmosphere, and a wet sponge being placed in the interior of the apparatus, the other having highly heated quicklime within, so that in such a case its interior air might be completely dry. Both, being submitted to a feeble calorific radiation, gave sensibly the same disengagement of gas. If the state of dryness or humidity were the cause of the observed phenomenon, it necessarily would follow in the experiment that the currents of gas would be in inverse direction, which was not the case. Still, even with this fact of the porous vase being a prime necessity established, we are yet without a satisfactory explanation of the discovery. It can only be pointed out that the circumstances may play an important part in certain natural phenomena. After studying the gaseous exchanges between vegetation and the atmosphere, M. Merget concludes that a plant should be regarded as a moist and porous system, possessing the thermo-diffusive activity proper to all similar systems under elevation of temperature.

The leaves of aquatic plants, from this point of view, have considerable activity, and the quantity of gas introduced in the plant may reach 30 cubic inches per minute. A leaf having a long petiole (that of the *nuphar*, for example) was placed in air, while the free extremity of the petiole was placed considerably beneath the surface of water in a test tube. The apparatus being submitted to solar rays, nearly pure atmospheric air passed rapidly under the tube. This took place as if the leaf were a natural thermo-diffuser; and the phenomenon is purely physical in character. The respiration of animals may also be a similar phenomenon; but this has not been sufficiently demonstrated to warrant an affirmative assertion.

The facts of M. Merget's discovery are interesting both from a physical point of view, and in that they tend to explain effects of which the causes are as yet undetermined. They go to show, besides, the mutual interdependence of sciences, the domains of which formerly appeared absolutely distinct.

PRACTICAL INFORMATION FOR PRACTICAL MEN.

The leading article of the *Journal of the Franklin Institute* for August begins with the positive assertion that the general idea that practical information, useful to a practical man, can be made interesting or instructive to the ordinary reader is an altogether erroneous one. And after a six-page amplification of this discouraging thesis, based on the half century's experience of the *Journal*, the writer closes with the sweeping remark that there is an incompatibility, now and for all time, between practical and popular information.

Bearing in mind the warning of an American humorist: "Don't never prophesy unless you know": we would not venture to contradict the *Journal* with regard to the possibilities of "all time;" but for the time that now is, we do not hesitate to say that there is no such incompatibility. And further, an expression of thirty years in trying to meet the popular demand for practical information has given us an abiding conviction that, as in the past, so in the future, in a yearly increasing degree, practical information useful to practical men will more and more be desired by intelligent readers; and the success of periodicals devoted to Science and the arts will hinge more and more—as scientific thinking increasingly prevails—upon their presenting promptly, clearly, and sensibly the very information which the *Journal* asserts to be so essentially unpopular, that is to say, practical information really and truly considered. The impossibility of making attractive to the general reader the stuff which the *Journal* describes as alone worthy of that title, we should not think of doubting. The *Journal* has sufficiently demonstrated that it cannot be done. We doubt whether it could be done even for the ludicrously limited class of men to whom the *Journal* would apply the term practical; in its own words, a few specialists, each of whom "must have acquired, in the course of his practice in some particular direction of knowledge, enough to have compelled him to have learned its 'science,' regularly and methodically, to have investigated by his reasoning faculties and founded himself upon principles and not on half-comprehended facts."

The definition is not very grammatical nor very clear; but we gather from it, and from subsequent remarks, that the practical man must not only be a specialist in scientific investigation, but one so furnished with all that has been accomplished in his particular department that no information can be practical to him unless it is wholly original and presented along with the most thorough and elaborate reasoning and formulæ that may be required for its support and demonstration. "It is the progress and advance of the arts and sciences, not the arts and sciences themselves, that the practical man needs information about;" and the method approved for the presentation of such additions to "practical" knowledge is the dryest and most elaborate possible, albeit the investigation is "tedious," the discussion "recondite," and the concluding results "unintelligible, almost incomprehensible, to any others than practical men in an extremely limited kind of practice."

It is not surprising that the *Journal* finds an incompatibility between such information and popularity: but it *is* surprising to find an editor of intelligence coolly assuming that such information exhausts the limits of the practical, and that no man deserves to be called practical who does not delight in it. The position is sufficiently absurd to be grotesque.

WORKMEN AND THEIR INSTRUCTORS.

A hammer and a chisel are two very simple tools, and surely it seems there can be no great mystery in the use of two such implements; but a foreign language, or the groundwork of a whole science, can be learned in far less time than it takes to learn to chip a piece of metal an inch long so so smoothly upon its surface that the chipping marks cannot be felt. The reason for this difference is simple, and lies in the fact the language or science has teachers who are masters of their subjects, and who make those studies the work of a lifetime; whereas the mechanic has as a rule to work out the whole problem for himself. It is as ridiculous for a man whose ten or fifteen years' experience has included the principles of construction, mathematics, mechanical drawing, etc., to assume to teach that intricate knowledge of manipulation necessary to make an expert workman as it would be for a workman who had spent his leisure time in reading books of science for instruction to attempt to instruct the scientific world; and this would have been made apparent long ago but for the lack of education so common to expert work men, and but that, so soon as an expert workman attains the knowledge of his trade, and the skill in the use of language which enables him to enter the arena of debate or tuition, he ceases to be a workman and becomes too often a stranger to the workmen's interests. Such a faint conception of the real value of an unusually expert workman is possessed by employers that, if he possess such a qualification only, his sphere of usefulness is limited to his practice, and he would search the wide world in vain for a means of giving to others the benefits of his skill by imparting to them the minutiæ of movements, processes, forms, time, speed, etc., which, combined, form that skill which is best known as manual dexterity. There never has been nor can there ever be a piece of expert workmanship done that was not governed by distinct principles and laws; and the misfortune is that they are to a very great extent unwritten laws. Volumes are written for the edification of the workmen that had better far never have had existence. Can the workman do aught but smile at the statement, given under assumed authority, to the effect that tools for cutting wood can be much harder than for cutting iron, or, to state it better, "tools for cutting wood are harder than those usually employed for cutting iron"? And what are we to think of the advice that "the better way to make a scraper" (for flat surfaces) "is to form it like a Venetian stiletto or a beech nut"?

Not long ago, a statement went the rounds of the mechanical press to the effect that a certain French mechanic had discovered a method of reducing the diameters of the tires of locomotive wheels by a process of partial immersion in water: whereas such was the practice twenty-five years ago, and it has been in common use ever since: principles governing the process, together with its application to wheel tires, having been published, together with an illustration, months before in the SCIENTIFIC AMERICAN. Instances of this kind are so numerous that it would take a volume to recite them, nor would the recital bring us any nearer to a solution of the question of how best to impart manual dexterity by means of instruction. Our knowledge of practical mechanics, as commonly applied in our machine shops, is crude in the extreme, and will continue to be so until we have placed within reach of the workman all the intricate knowledge that goes to the very bottom of expert workmanship, which information can only be obtained by practical experiment, made by men chosen by reason of their mechanical skill, under the directions of teachers capable of explaining and formulating the principles and rules governing the practice of the skillful artisan.

BORN SCIENTISTS.

The importance of the innate tastes of an individual being considered in determining the choice of a trade or profession is well shown in Mr. Francis Galton's recent work on the antecedents of English men of science, a volume prepared as a sequel to the treatise on "Hereditary Genius" already reviewed in these columns. Mr. Galton adopted the excellent plan of a well chosen series of questions, which every scientist was requested to answer and return to the sender. One hundred and eighty scientific men were thus questioned, and the replies which most appeal to the thoughtful are those relative to prevalent tastes. We should expect to find a taste for mechanics among the physicists, and such is the case: the same among the mechanicians and engineers. The underlying cause of scientific research may be traced in the repeated mention of the possession of a "desire to know facts," curiously coupled in some cases with a strong repugnance to works of fiction. More interesting, however, is the schedule of influences and motives which urged the various individuals to follow scientific pursuits. Out of 191 people, innate taste for their calling influenced 59; fortunate accidents (generally showing innate taste), 11; indirect opportunities and indirect motives, 19; professional influences to exertion, 24; encouragement of scientific inclinations at home, 34; influence and encouragement of friends, 20; of teachers, 13; travel in distant regions, 8; residual influences, unclassed, 3. The large plurality in favor of innate taste is striking. Now take the various callings: Out of 26 cases of physicists and mathematicians, 12 had an innate taste, 1 no natural taste at all and 7 are doubtful. Of 11 chemists, the taste of 5 was innate, 1 not, and 5 doubtful; of 8 geologists, 7 innate, 1 doubtful; of 24 zoölogists, 17 innate, 3 not, 4 doubtful; of 10 botanists, 8 innate, 1 not, 1 doubtful; of 7 medical men, 2 innate, 4 not, 1 doubtful; of 6 statisticians, 3 innate, 1 not, 2 doubtful; of 5 mechanicians, 2 innate, 3 doubtful.

It is clear from this that a strong and inborn taste for science is both a prevailing and an enduring peculiarity of the persons considered. A fair estimate for Mr. Galton's deductions is that out of every ten men of science, six were naturally gifted with a strong taste for scientific pursuits. Not one person in ten, taken indiscriminately, possessing such an instinct, it follows that its presence must add five fold to the chance of scientific success.

The possession of a special taste for any pursuit is therefore a gift of Nature not to be slighted, and it is in fact something to be seriously studied and its development advanced.

EDUCATED FARMERS.

If we were asked to point out any especial fact as denoting beyond all others our rapid progression in knowledge and in civilization, we should select the strong tendency everywhere manifest to abolish empiricism in all pursuits of life. It is not very long ago that the physician administered his remedies blindly, and knew less of the functions of the heart than does his modern descendant of the spleen and gall bladder. Meteorology, most fickle of all sciences, based as it is on the most changeable of all things, the weather, has within a very few years made marvelous strides; and we are certainly advancing to a point when it will be as easy to foretel the rain and storm of tomorrow as to remember the fine weather of yesterday. Even cookery is no longer to be the science in which unaccurately compounded ingredients, under constantly varying conditions, are supposed by some pleasant fiction to yield invariable results for has not a college been endowed, to educate our future *chefs de cuisine*? Thumb rules in every trade are now scouted by intelligent working men. The world has shaped itself into a gigantic point of interrogation; "why" is the question of the hour, and faith in things earthly is confined only to those who, like the deluded partisans of Keely and others of his ilk, mistake ignorance of that which is possible for belief in that which is not.

Of all the sciences, none within recent years has so quickly emancipated itself from the fogs of empirical conjecture as that of agriculture. Up to the end of the last century even, people believed that air, water, oil, and salts were the sources of plant nutrition. Wallerius, Bergmon, Palissy, Davy, De Saussure, and Sprengel contributed discovery after discovery, investigation after investigation, but their work was scattered and little known outside their laboratories. It was reserved for the genius of Liebig to unite all these fragments of truth; but it was not until 1840 that he produced his great work "Chemistry in its Application to Agriculture and Physiology," and thus gathered in concrete form the materials which are the basis of a now great and rapidly growing science. It is hard to realize that agricultural chemistry has found its application for but 26 years, so clearly are its benefits before us in tangible form. But on the other hand, this only serves to indicate to us how vast must be the results yet to come, when agriculture, through the instrumentality of its knowledge, shall have become in its turn as exact as its sister sciences, and as susceptible of being taught and learnt in the same manner as they. And to attain this much desired end, our schools and colleges, under the guidance of far-seeing men, are doing splendid work.

The youngest of our universities, Cornell, established an agricultural department three years ago, under the charge of Professor Roberts, the farm consisting of 150 acres, in not over good condition. Upon this tract of land the whole science of raising crops, as well as the business of managing a farm, is taught with a thoroughness which we doubt has ever been exceeded. Eighteen square rods of clover, for instance, are set apart for eighteen different modes of treatment with fertilizers. In the experiments with corn, three rows of each kind, or of each mode of manuring, or of the different modes of management in other respects, extend across the field. There are also experimental strips of oats and wheat; and thus every method of cultivation of all the farm products incident to our climate is practised directly before the student, who is required personally to perform the labor necessary in connection therewith. The results of the experiments are carefully recorded and stored away until sufficient shall have been gathered, over a number of seasons, to justify the determining of accurate averages.

Besides this, the students are taught a complete system of accounts. Every hour of labor hired, every product of farm sold, is minutely registered. The food which live stock consumes is recorded on one side and balanced yearly by the market value estimated by a skilled butcher. So that, in this way, the gains or losses, not only of the farm as a whole, but of every branch, are known with the utmost accuracy. Every student is required to become proficient in this account keeping. Each keeps his books separately, and determines estimated values; and as he may sell his own labor to the farm, outside the time required of him, which is but two hours and a half for two days of the week, he is directly interested in the task. Besides the farm, there is a garden of six acres, conducted under the same admirable system; and in addition, lectures on practical agriculture are given four times weekly by Professor Roberts. The *Country Gentleman*, to which we are indebted for these facts, states that the number of agricultural students is still too small, so that there seems to be abundant opportunity for all who may desire to acquire a thorough and most valuable education. Certain it is that such instruction is most urgently needed in this country. It has become too much the fashion for young men to crowd into the great cities, and there to eke out lives behind desks and counters which should be spent in developing the vast resources of the thousands of square miles wherein the richest soil on earth awaits the plowshare. In the Centennial Exposition are exhibited actual glass-enclosed sections of prairie soil with the black unctuous loam extending downwards far below the reach of the deepest furrow. Go look at that superb exhibit in Agricultural Hall, and think of the possibilities which educated farmers cultivating such land might accomplish. Think of it, stalwart young men, who meditate coming into the city after the present harvest is garnered, to find work where there is none to be had. Expend your labor and means at Cornell, Amherst, Dartmouth, and other like colleges, and obtain such an education as we have described then; "go West," pre-empt your land, and start on the high road to independence and ultimate fortune.

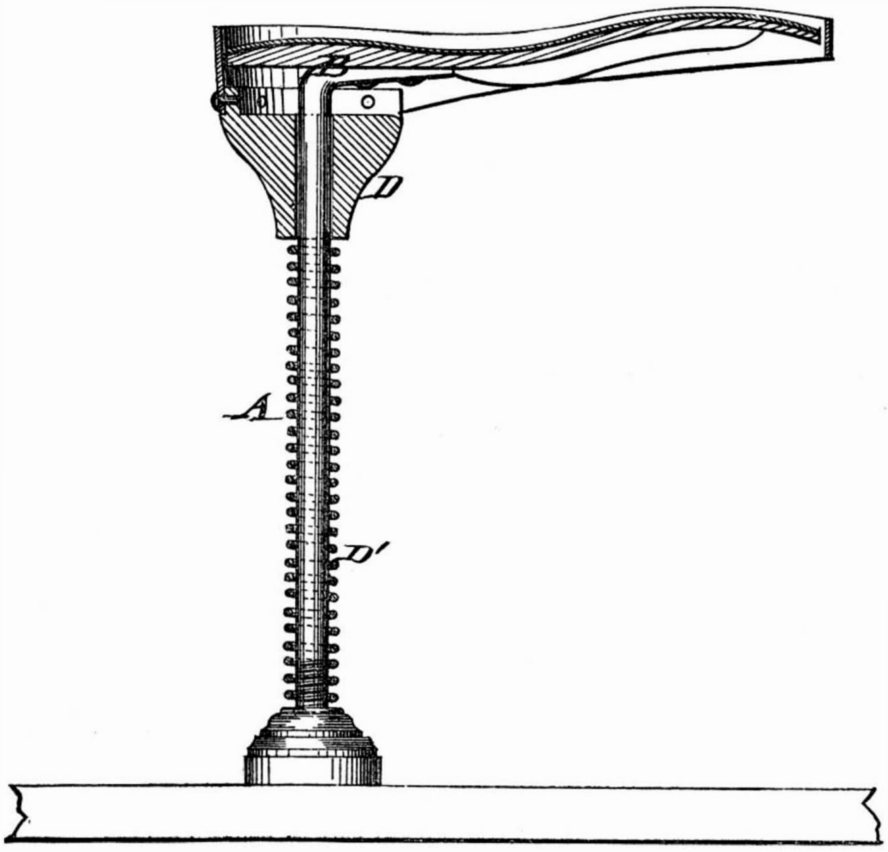
Crystallized Glycerin.

Dr. Armstrong recently exhibited, at a meeting of the Chemical Society, London, a specimen of pure crystallized glycerin. The solidification took place while the glycerin was being agitated on a railroad journey in cold weather last winter. Dr. Odling mentioned the curious fact that hydrocyanic or prussic acid is an excellent test for the purity of glycerin, the slightest admixture of any foreign substance causing the glycerin to turn yellow in a short time if a little hydrocyanic acid be stirred into the liquid.

IMPROVED APPARATUS FOR LINING INSOLES OF BOOTS.

Mr. Charles Monahan,of St. John, N. B.,proposes to apply the linings of boots and shoes in a quick and perfect manner by an improved machine, which we illustrate herewith.

There is an upright post,to the top part of which the last, B,is securely attached. A metallic guard, C, extends around the last, and is attached to a support, D, that slides on the upright stand. The support,D,and guard, C, are forced in upward direction, to project above the last, by a strong spiral spring, D'. The pasted lining is placed bottom upward on the last, and prevented from sticking to the boot by the guard, while the boot is drawn over the last. The guard is kept in position by its spring until the boot is in position to be pressed on the last. The boot forces the guard down, and presses the lining firmly on the insole of the sole, so that it sticks to the same in an even manner. The boot is then taken off, a new lining placed on the last, and the next boot brought down. This invention was patented through the Scientific American Patent Agency, July 4, 1876.



APPARATUS FOR LINING INSOLES OF BOOTS.

Powder for Producing Ozone.

"In order to produce artificial ozone, Mr. Lender makes use of equal parts of peroxide of manganese, permanganate of potassium,and oxalic acid. When this mixture is placed in contact with water, ozone is quickly generated. For a room of medium size, two teaspoonfuls of this powder, placed in a dish and occasionally diluted with water, would be sufficient. The ozone develops itself; it disinfects the surrounding air without producing cough."

The attention of the writer was called to the above article as it appeared in the Philadelphia *Medical and Surgical Journal*, under date of May 20, 1876. For the purpose intended, it is certainly one of the best of the published formulæ, but, on account of the danger attending its manipulation, should be used with extreme caution. A prescription with these proportions was taken to an apothecary, who inadvertantly used a mortar in mixing it, with the result of an immediate explosion, which would have been attended with disastrous consequences except for the smallness of the quantity employed.

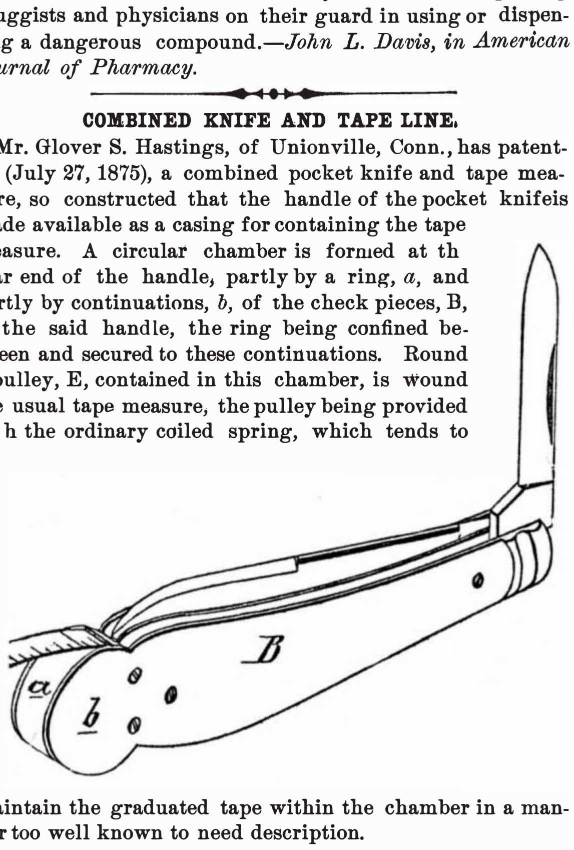
In mixing these ingredients, trituration should not be used at all, but they should be cautiously mixed with a spatula in small quantities; and even then, if they should have been reduced to a fine powder, they cannot be mixed without danger, as the mixture is liable to explode at the moment of contact.

Apothecaries who are not deficient in knowledge are sometimes deficient in caution, and articles published in reliable journals are copied and used without hesitation, and the compounder or dispenser is brought into unlooked-for and unexpected difficulties.

The above article is written solely with a view of placing druggists and physicians on their guard in using or dispensing a dangerous compound.—*John L. Davis, in American Journal of Pharmacy.*

COMBINED KNIFE AND TAPE LINE.

Mr. Glover S. Hastings, of Unionville, Conn., has patented (July 27, 1875), a combined pocket knife and tape measure, so constructed that the handle of the pocket knife is made available as a casing for containing the tape measure. A circular chamber is formed at th rear end of the handle, partly by a ring, *a*, and partly by continuations, *b*, of the check pieces, B, of the said handle, the ring being confined between and secured to these continuations. Round a pulley, E, contained in this chamber, is wound the usual tape measure, the pulley being provided wi h the ordinary coiled spring, which tends to



maintain the graduated tape within the chamber in a manner too well known to need description.

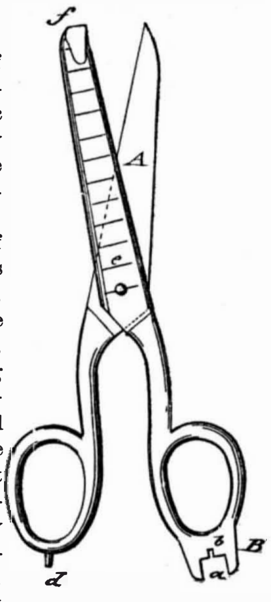
New Coal Fields in Utah.

Professor J. E. Clayton has returned from an extended visit to the coal fields in Wasatch county, Utah, and gives us some interesting and valuable information in relation thereto: "The coal mines are the first of the extensive series that stretch south through San Pete county. They are situated in Pleasant Valley, and are reached by going 40 miles due east from Spanish Fork station up the cañon to the summit, and thence south seven miles to the south end of the valley, making a total distance of about 105 miles from Salt Lake city, 58 of which are by rail. The wagon road of 47 miles is easy, there only being about two miles of up grade from the mines to Spanish Fork city. The rest of the way is down the cañon on an incline averaging 66 feet to the mile. The highest altitude on the road is the summit of the cañon, which is about 7,750 feet above the level of the sea. Pleasant Valley is at the head waters of Price's river, which ultimately flows into the Colorado, and is about four or five miles long by two or three in width. At its lower end, numerous cañons put into the valley; and at the base of the hills around these, the coal shows in a semicircle west and east around the valley for six or eight miles. Two, and in some places three, beds show one above the other; the principal one, the Hutchings, being 32 feet in thickness and lying horizontally on the east side of the valley and trending to the south east. The region is cretaceous sandstone, and the Hutchings shows a foot wall of light gray sandstone with a yellowish gray sandstone roof. In the neighborhood is but very little shale, there being no shale seams whatever in the coal bed. No iron is visible, although higher up in the mountains is seen ferruginous sandstone, which, however, indicates nothing permanent. About one half of the bed of coal is of an excellent coking variety, the specimens we saw, though made in a primitive manner, being equal to the best imported. The coal beds are at an altitude of about 7,550 feet.

The surrounding hills have fine pine timber in sufficient quantity for local purposes, while an abundance of water is close by. Considerable importance can be attached to these coal fields for their accessibility, their great extent, and the coking qualities of their product.—*Salt Lake Weekly Miner.*

NEW COMBINATION TOOL FOR SEWING MACHINES.

We illustrate herewith an ingenious arrangement of all the tools, used in the care and adjustment of sewing machines, in a single implement. It is the invention of Clara A. Rogers, of New Orleans, La., and was patented through the Scientific American Patent Agency, July 11, 1876. The tools combined are a scissors,wrench,needle straightening device, throat plate mover, screwdriver,and measure. One of the handle parts of the scissors is provided with an extension, B, that has a square recess, *a*, for the purpose of serving as a wrench, the stocks of the scissors serving as handles. The recess, *a*, is further provided with a short and narrow slot, *b*, which serves for the purpose of straightening bent needles. The other scissors handle has an extension pin, *d*, by which the throat plate of the machine, whether of glass or metal, may be readily moved without



the use of a separate tool. One or both stocks of the scissors may be graduated to form an inch or other measure, *e*, which is very handy, as the scissors are at any moment available; and the end of the broader stock is made tapering to form a screwdriver. The whole forms an exceedingly convenient and useful tool.

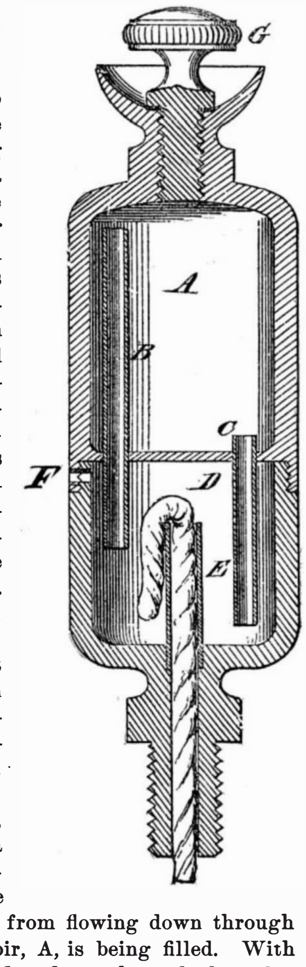
SILVER discoveries have been made in the vicinity of Arthur's Landing, on the north shore of Lake Superior, about 200 miles northeast of Duluth. A miner dropped down upon some crumbled quartz containing native silver. The rock is expected to yield $3,500 or $5,000 per tun

What a British Centennial Judge Thinks of Us.

The London *Times*, of August 14, gives unusual prominence to a letter written by an English judge at the Centennial, which the Philadelphia *Ledger* copies, and of which it also gives the substance in an editorial as follows. Captain Galton, the judge, says that he saw enough there to convince him that American manufactures had been making remarkable strides during the past twenty years. Captain Galton is one of the engineers appointed by the British Board of Trade to survey railways and other public works before they are opened for public traffic; and he was a British judge in the group of railway appliances, and immediately upon his return home he penned this letter. He had previously visited this country twenty years ago, and during the interval we all know that American manufacturing progress has been remarkable. He speaks of the great advance in our industries as shown by the growth in the amount of coal mined, and says that our higher wages, compared with England, are counterbalanced by the use of machinery to an extent much exceeding that generally in use in England. Observing the substitution of steel for iron rails on our railways, he candidly remarks that the new rails are almost all made in the United States, and that it is not probable that England will be called upon much longer to supply us with rails. He goes further, and, speaking of general manufactures, says England can no longer expect to get a market for her manufactures in the United States, but she must be prepared to find our manufacturers competing with her in every market to which they have access. Mr. Galton bluntly tells the *Times* that England should appreciate her true position in this matter, and he closes by urging all Englishmen to visit Philadelphia, where they can see the development of American industry, and meet the leading manufacturers as well as the most prominent Americans of all classes.

A NEW OIL CUP.

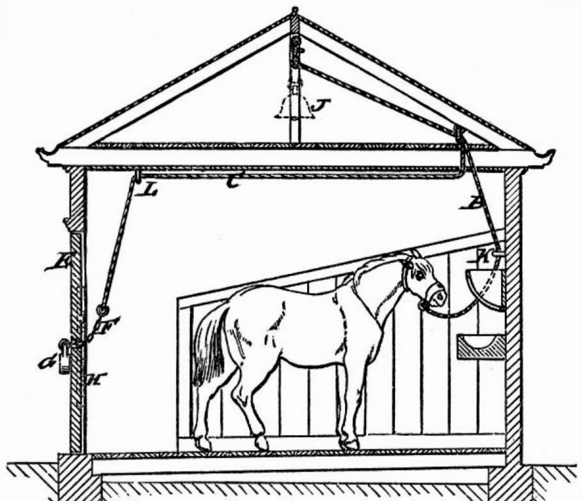
Mr. Ezra B. High, of Reading. Pa, has patented (July 4, 1876) through the Scientific American Patent Agency a novel improvement in oil cups, which we illustrate herewith. The object is to furnish a constant and uniform supply of oil to the bearing at all times. The cup is made in two parts, A D, which are screwed together. The upper part, or reservoir, A, receives a screw plug, G, so fitted as to be airtight. The lower part or distributing chamber, D, is made with a perforated screw stem, to be screwed into the journal or shaft box, and in the upper end of the perforation of which is secured a small tube, E, to receive the siphon wick by which the oil is carried to the journal to be lubricated. In the bottom of the reservoir, A, are secured two tubes, B C. The upper end of the tube, B, rises nearly to the top of the reservoir, A, and its lower end extends down into the distributing chamber, D, so far as to be below the end of the tube, E. The upper end of the tube, C, rises a little above the bottom, a^1, of the reservoir, A, so that any sediment that may be in the oil will settle upon the bottom of said reservoir, and cannot flow through the tube, C, into the distributing chamber, D. The lower end of the tube, C, may be bent up into such a position that a plug may be inserted in it through the air hole or vent, F, to prevent the oil from flowing down through the tube, C, when the reservoir, A, is being filled. With this construction the oil will flow down through the tube, C, into the distributing chamber, D, until the lower end of the tube, A, is covered, which will prevent the entrance of any more air into the reservoir, A, and will stop the flow of the oil until enough oil has been carried out by the siphon wick to again uncover the lower end of the tube, B, and allow air to again pass up through the tube, B. In this way the oil will be kept at about the same level in the distributing chamber, D, so that the siphon wick may carry it out in a uniform quantity. Air, to supply the place of the distributed oil, enters through the vent, F.



As at present worked, the gold and silver mines of Japan do not appear to be of much value. Iron ore is abundant and the mines are rich. Magnetic ore in sand and lump is most commonly used. Lead is extracted in many provinces, but in a faulty manner and in small quantities. Some of the ores are very rich. Tin is reported to be found in two localities, and the quicksilver mines are not worked

IMPROVED CONSTRUCTION OF STABLES.

Mr. Frank M. Dixon, of Jefferson City, Mo., has recently invented a contrivance for hitching a horse and fastening a stable door in such a manner that the horse will be freed and the stable door opened in case of fire in the stable, and a contrivance for sounding an alarm at the same time. The engraving shows a transverse section of a stable having the improved appliances. A cord, of cotton or other combustible material, is stretched along the space above the stable, from side to side, to which the halter of the horse is attached. A cord, C, holds the door, E, shut—say, by a chain, F, and a padlock, G—and the door has a spring, H (dotted line), to throw it open when the cord is released. There is another cord, extending along the space above the stable, from side to side, and connected to an alarm bell, J, and also having the halter and the door cord attached; so that when the cords are burned off by fire, the door will spring open, the horse will be released for escape, and the alarm bell will sound. The halter will pass down from the space above, where it is attached to the cord through guides, K, and the door cord will pass along through suitable guides. The invention was patented on July 18, 1876.



The United States Patent Association.

This society meet on September 7, 1876, at the Franklin Institute, Philadelphia, Pa., for the purpose of suggesting means for the improvement of the patent system and the formation of an international association for promoting uniformity of patent laws in all countries. Among the members present were Hon. J. M. Thacher, ex-United States Patent Commissioner; Professor Hedrick, of the United States Patent Office; W. C. Dodge, of Washington, and John S. Perry, of Albany, N. Y., President of the Association.

President Perry called the meeting to order, and read an address, in which he took as subjects of consideration: First, the importance of the patent system in general; and, second, that of the United States in particular, viewed both in respect to the development of original invention and as inciting inventors to persevere in the perfecting of their plans. He showed the benefits which have arisen from the patent system by a review of the condition of Europe before the patent law was recognized. So long as the laws of property were neither recognized nor properly defined, there could be little incentive to invention or the pushing forward of appliances for the better comfort of mankind. Often an individual, like Roger Bacon, would be on the eve of an invention, and often for that matter did invent; but, well knowing that his rights would be unrecognized, he failed to make it public. Indeed it is well known that several inventions and discoveries of great value, which have since been re-invented, were really made, but suffered to die with the inventor or discoverer from this cause. The first trace of patent law is, he thought, to be found in the reigns of Henry III. and Edward IV., of England, in the thirteenth and fifteenth centuries, about which periods the services of the villains or serfs gradually became less onerous and uncertain.

He furthermore said: "Patents are sometimes characterized as monopolies and even as vicious monopolies. With equal reason might the possession of wealth honestly acquired be denounced as a trespass upon the rights of others. To take money unlawfully is called stealing; to appropriate an invention is not by some considered very dishonorable. The public seem to have lost sight of the fact that the inventor has taken nothing which it had before; that he has from his own brain brought into existence and perfected, at his own cost of labor and money, a production as new to the world, and perhaps as useful, as the gold which the miner brings forth from the hidden recesses of the mountains. The most bitter opposition the patent system meets is from the agriculturists, and they of all men are the most benefited by its provisions. With the high cost for labor that has existed during the past twelve years, the business of farming could not have been carried on without the improved machinery that inventors and progressive manufacturers have provided.

"The importance of the patent system in general is shown in that a vast number of articles have been through its instrumentality added to the means of human happiness, of which the latter must otherwise from necessity have been deprived. In reference to the importance of the patent system in the United States, the speaker argued that the history of patent protection is almost coincident with our existence as an independent nation. The law of patents, as it now stands in the United States, rests on the statutes of February 21, 1783, and April 7, 1800. These statutes have been modified several times, yet our patent law as it now stands is far from being perfect, and it is in the hope of aiding in correcting its errors, and in giving it a wider scope, that the United States Association has been formed."

REMARKS: These views are in the main sound, although tinged with a few misconceptions. Patents, the chairman assumes, are not monopolies, but inherent rights. The poor miner, who controls the gold that his industry brings from the rocks, is just as much of a monopolist, he tells us, as the wealthy patentee, who compels every poor woman to pay him forty dollars royalty, for the privilege of earning her living by means of his patent sewing machine. Such reasoning, Mr. Chairman, will not do. The people know better. They know by actual daily experience that patents are monopolies, some of them of the most oppressive kind; and no sugar-coating by any Patent Association will alter the fact. It is because patents *are* monopolies of the vicious kind, that they are valuable, and in such great demand. Of what account would a patent be, if the patentee were not clothed with authority over his fellow creatures to enforce his private demands, in respect to his patent? Of none whatever.

According to President Perry, the miner who first discovered gold in the Rocky Mountains was the natural patentee of the entire range, as respects the precious metal. He takes nothing that the public had before; on the other hand, by his discovery, he contributes to the general supply of gold. Therefore, no one but the discoverer, or the favored few whom he permits, ought to be allowed to work at gold mining on the premises. This is poor logic for the United States Patent Association to promulgate.

Patents, as we have stated, are pure monopolies. They are only tolerated and granted for reasons of public policy. They are issued solely as rewards: for the mere purpose of stimulating people to discover, invent, and study out new forms of industry. The general weal is promoted by increasing the number and variety of industrial arts, which all the people may freely and equally enjoy. Instead of rewarding the inventor by paying him a sum in cash from the collected taxes in the treasury, the government gives him a patent, or, in other words, makes him his own tax gatherer; and authorizes him to compel the people, by force if necessary, to satisfy his demands.

The redeeming feature of our patent monopoly system is that it effects its object, it brings out new improvements, and is limited to a brief period. Our patents run for seventeen years—a short time in the life of a nation; the inventions then become public property, and everybody may enjoy them, free from the annoying whip and spur of any wealthy private corporation or patent holder. Great as are the inconveniences of our patent system, the benefits are amazing, and greatly exceed the drawbacks. So long as this continues to be the case, the patent laws will stand.

A PAPER EGG CUP.

Here is a new application of that all-useful commodity, paper, to the purposes of table furniture. Mr. R. M. Washburn, of Burlington, Iowa, has patented a paper egg cup, which, besides being a really ingenious idea, is based on sound theory, inasmuch as paper is a non-conductor of heat; it is elastic, so that one cup will hold securely an egg of any size; and it is molded in corrugated form, so that there is always a circulation of air between the egg and its vessel, which is represented in our engravings as empty in Fig. 1, and holding an egg in Fig. 2. The same cups may be used over and over again, or may be thrown away after each meal, their cheapness allowing of this latter disposition. They are handy for picnic parties or for persons traveling, and as novelties for hotels, restaurants, and even private houses. The material may be paper, muslin, or almost any fabric. Tinted of different colors, the cups would be quite ornamental; or they might serve as a medium for advertising, so that the person using them may have food for digestion mentally as well as physically. The invention is one likely to be remunerative. It is just such cheap and simple devices which, now-a-days, are most in demand, and produce the largest profit. Those desiring to negotiate for the right to manufacture can obtain further particulars by addressing the inventor as above.

Fig. 1.

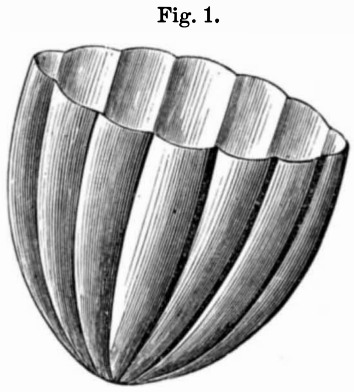
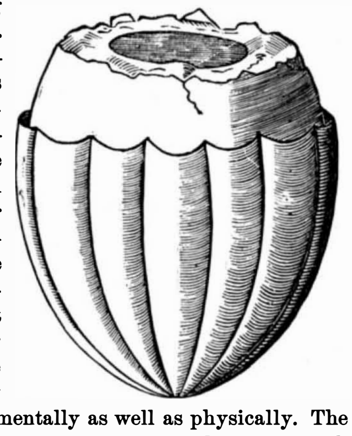
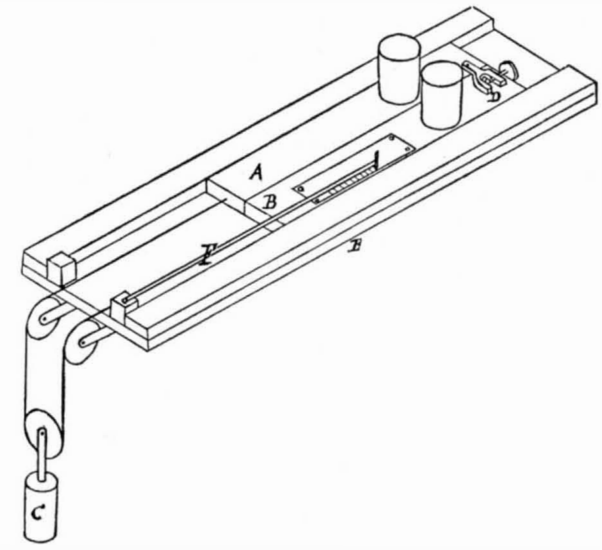


Fig. 2.



A SIMPLE DIVIDING MACHINE.

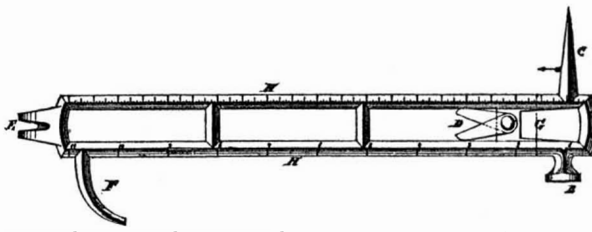
Among the exhibits of the Massachusetts Institute of Technology, at the Exposition, is a novel instrument devised by the professor of physics, to be used as a dividing machine for graduating scales of equal parts. It can be constructed for a trifling outlay by any one who understands the use of tools, and by its aid scales can be laid down with considerable accuracy. It consists of two strips of wood, A, B, which slide in a wooden frame, E. The ends of a cord are fastened to these strips, the cord being fastened, as shown in the engraving, to the weight, C, which is heavy enough to slide the strips along the frame. The slips can, however, be kept in any desired position, by placing weights upon them.



At the upper extremities of the slips is a fork-shaped piece of metal which is secured to the strip, A, by a pin, on which it can turn; and a pin on the strip, B, engages the fork, allowing a certain amount of play, which can be varied at pleasure by the adjusting screw, as shown in the engraving. An arm, F, is attached to the frame by a pin, and has a pencil at the end, this being the marker for constructing the scale on a piece of paper which is fastened to the strip, B. To show the action of the instrument, suppose the adjusting screw is turned so that the play of the fork is $\frac{1}{100}$ of an inch. A piece of paper is secured to the strip, B, and a mark made upon it with the pencil. The weight is then lifted from the strip, B, when it will be slipped along a distance equal to the play of the fork, or $\frac{1}{100}$ of an inch, and a second mark is made with the pencil. Then the weight is replaced on the strip, B, and that on the strip, A, is removed, when B will be slipped along until it is square with B, a stop preventing the fork from turning back any further. The weight is replaced on A, the other removed from B, a third mark made, and so on, alternately moving each strip through the required distance, until a sufficient number of divisions is obtained. R. H. B.

NEW COMBINATION TOOL.

Mr. Lester Beach, of Derby, Conn., is the inventor of a novel and ingenious combination tool, an engraving of which is presented herewith. The body of the tool consists of two parallel bars, connected at their ends, and at suitable distances apart between said ends by crossbars, so as to make the tool light and at the same time strong. Upon one end of the tool is formed a screwdriver, A, near which is a hammer head, B; and upon the other edge is an ice pick, C. To one of the crossbars are attached two small steel plates, D, arranged at an angle, so that they may be used as a knife sharpener. Upon the other end of the tool is formed a notched claw, E, for pulling tacks and for lifting stove covers. Upon the edge, diagonally opposite the ice pick, C, is formed a curved finger, F, which may be used as a poker and as a pot lifter. At one end the space, G, is made slightly tapering, and the inner edges of the side bars are flattened, to adapt said space to be used as a wrench for turning various sized nuts. Upon the side bars of the tool are formed division marks of inches and parts of an inch, to adapt the tool to be used as a rule, H. Patented through the Scientific American Patent Agency, August 1, 1876.



The East River Bridge.

Chief Engineer Roebling now intends to hoist a carrier rope of $1\frac{3}{4}$ inches diameter, instead of $1\frac{1}{4}$ inches, as originally intended, between the towers of the East river bridge. The increased weight will prevent the carrier rope from being hauled across by the traveler ropes now in place; and it will have to be carried across the river in a scow and hauled taut between the towers, as was done in the case of the first traveler rope. Two $1\frac{3}{4}$ inches carrier ropes will be placed in position; and then the cradle and foot bridge ropes will be hung on them by pulleys. The carrier ropes are of chrome steel wire, and will weigh about 22,000 lbs.

A Statue of Lafayette.

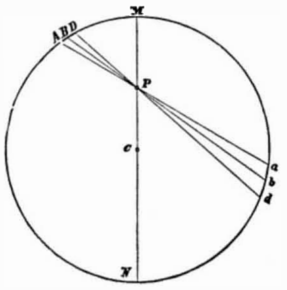
The French republic has recently sent, as a gift to the citizens of New York, a bronze statue of Lafayette, the renowned soldier whose zeal in the cause of republicanism brought him to this country 99 years ago, and enlisted him in the army which achieved our independence. The statue has been erected in Union Square, looking down Broadway; and it was unveiled on September 6, with appropriate ceremonies.

Correspondence.

The Weight of a Body Inside a Hollow Sphere.

To the Editor of the Scientific American :

I am surprised at the half knowledge shown by your correspondents in their discussion of the attraction of a hollow sphere on a body within it. Can any one name a scientific man of repute who has repudiated it, or the demonstration of it, which is to be found in "Newton's Principia"? If Mr. Whitmore chooses to represent the mass which exerts the attraction on the body, P (see the illustration on page 84), by the cup-shaped fragment, B E F G C B, his position is undoubtedly correct; but the calculation of the attraction becomes so troublesome that we may well ask for a simpler way. Newton's theorem furnishes this.



In a thin shell, whose section is the circle at A M a N A, let a body, P, be found; draw through P in any direction the line, B P b, and revolve around it the line, A P a, which makes with it the small angle, A P B: the resulting circles, shown in section at A D, a d, will have the areas $\pi(AB)^2$, $\pi(db)^2$, and the masses $=\pi m t (AB)^2$, $\pi m t (db)^2$, where $t=$ the thickness of the shell, and $m=$ the quantity of matter in the unit of volume: the attractions on P will equal these masses divided by the squares of the distances from P, namely, P B, P b, and multiplied by a constant, f, thus: Attraction at B : attraction at b :: $\frac{2\pi m t f (AB)^2}{(PB)^2} : \frac{2\pi m t f (db)^2}{(Pb)^2} :: \frac{(AB)^2}{(PB)^2} : \frac{(db)^2}{(Pb)^2}$. But from the similarity of the very acute angled triangles, A B P, d b P, we have A B : B P :: d b : P b. $\therefore \frac{(AB)^2}{(BP)^2} = \frac{(db)^2}{(Pb)^2}$, and therefore attraction at B = attraction at b. That is, the body, P, will not move in either direction along the line, B P p; and as this line may be drawn in any direction whatever in the shell, the body at P will not move in any direction, and will therefore be in equilibrium at every point. To prove this for thick shells or hollow spheres, it is only necessary to conceive them as made up of an indefinite number of thin ones.

Professor Olmsted has been placed in apparent contradiction with this truth because it was forgotten by the writers who quoted from him that the attraction of gravitation varies inversely as the square of the distance. Thus, if the body be lowered half way to the center, it would be attracted by a mass equivalent to one eighth of the original sphere; but as the distance between the body and the center of the sphere is only one half of what it was before, the attraction will equal $\frac{\frac{1}{8}}{(\frac{1}{2})^2} = \frac{1}{8} \div \frac{1}{4} = \frac{1}{2}$: or in general, if the force at the surface of a sphere, of radius r, be represented by 1, and the portion lost in descending a distance, d, by x, we have: $1 : 1-x :: \frac{r^3}{r^2} : \frac{(r-d)^3}{(r-d)^2}$; $\therefore 1 : 1-x :: r : r-d$. $\therefore 1-x = 1-\frac{d}{r}$ or $x = \frac{d}{r}$; that is, a body lowered toward the center of the earth would lose in weight and proportion to its distance downward, as Olmsted says.

Your correspondent further confounds attraction with weight when he says: "Guided by this theorem, we should expect a hollow sphere to balance if suspended from any possible point within the void." Not at all. The confusion comes from not distinguishing between the attraction between the earth and the portions of the shell on opposite sides of the point of support, and the almost infinitesimal attraction between these portions and any body at this point.

The theorem is in fact not to be proven experimentally, but is an inevitable consequence of the grand, often verified, never disproved law that every body attracts every other with a force directly as the product of its mass, and inversely as the square of the distance between them, that is,

$$f = \frac{m m'}{d^2}.$$

It should perhaps be added that the demonstration above given, as Newton himself pointed out, is only true when each shell is homogeneous, though neighboring shells may vary in density to any extent. In the case of the earth, the curious result is found that the center of the earth is so much denser than the part near the surface that the force of attraction increases at first on descending; and so Professor Airy's clock, in the mine 1,250 feet deep, gained 274 seconds daily. C. K. W.

Malone, N. Y.

South American Birds.

To the Editor of the Scientific American ;

On the eastern shore of the Uruguay river, from Paysandu to Independençia, there is an open rolling country with frequent small ravines, of which are bordered with a narrow skirt of timber of stunted growth and flowering shrubbery, which makes a fine retreat for the birds, and also frequently shelters the deer, South American tiger, and wild cat, which, however, are not abundant. The hill tops are also crowned with timber of similar growth, making a pleasant shade and resort from the scorching sun. Except on the hill tops and in the ravines, the country is partially covered with tall coarse grass, which makes a fine cover for quail and partridge. On approaching a ravine, the first thing that attracts your attention is the hum of the humming birds, which are of numerous different varieties, each bird balancing nicely on its wings while it inserts its long slender bill and extracts sustenance from the desert flower. Along the ravines, wild pigeons, similar to ours, are to be found in plenty, and are easily bagged. Next is the small partridge, very much like our northern quail, which are difficult to bag on foot and without a dog, as they will hide in the tall grass; but with a trained dog, the sport is fine. On horseback, you may almost ride over them before they will fly up. They are in flocks generally, yet they do not huddle; and it is difficult to get more than one at a shot. But you may sit on your horse and shoot a whole flock singly, as they seldom fly except they are flushed by a dog. The large partridges, which closely resemble English pheasants, are generally found singly, and the mode of catching these birds is rather peculiar.

They are found amongst the tall grass. The sportsman is mounted (carrying no gun, however) and has his dog trained to the work. He walks his horse slowly along, while the dog hunts about amongst the grass; and when he comes close upon the bird, the latter breaks cover, rises a little above the grass, and flies off on a level. When the bird flies, the sportsman puts his horse to his mettle and follows to the spot where he sees the bird alight (probably a hundred yards), and waits the arrival of the dog, who follows at his top speed and rushes in amongst the grass; and soon again the bird breaks cover and flies as before, but only about half as far. The sportsman and dog follow up as before, and the bird is hunted out again by the dog, and divides the distance again, and drops into the grass, pursued by sportsman and dog, this time closing the race for life. The dog rushes into the grass and directly comes out again with the bird unharmed in his mouth; the sportsman in the meantime dismounts and receives the bird, and disposes of him as he thinks proper. I was once an eye witness of such a race, and was told that these birds never break cover but three times, which seems to me rather strange.

Stratford, Conn. TRUMAN HOTCHKISS.

The Atmosphere of the Moon.

To the Editor of the Scientific American:

The moon is considered, by some astronomers, to have no atmosphere, as you mentioned in a recent issue; and in the article you gave some very plausible reasons for supposing that there may be an atmosphere of some kind on that body.

Heat, as you say, would have a great influence in expanding the air to a great extent, and rendering it so rare that it would extend out from the surface of the moon a great distance, so that its presence could hardly be detected by us. Yet when the moon cooled, the air would be condensed, and then be as dense or denser than our atmosphere, and could be easily detected.

To prove that the detection of the presence of the atmosphere would be difficult when the air was rare, and comparatively easy when the same bulk of air is made to occupy a smaller space, is very simple; for if we take a cubic foot of air or any other gas of the density of our atmosphere, the refraction of a ray of light passing through it would be very evident; but, if the same amount be made to occupy one hundred cubic feet, the refraction would be very much more difficult to detect, for, according to the old rule, "the greater the difference of the densities of the two gases, the greater the refraction, and *vice versa*."

Covington, Ky. WILLIAM L. DUDLEY.

The Direct Motion of the Radiometer an Effect of Electricity.

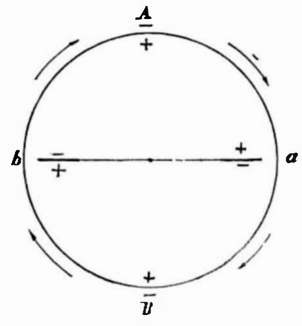
To the Editor of the Scientific American .

In the communication I sent you a few days ago, upon the radiometer of Professor Crookes, I showed that the exterior of the glass globe was electrified negatively when exposed to luminous or calorific radiations. Having made, since that time, some more experiments, I have discovered new facts which enable me to explain at least some of the motions of this wonderful instrument. The facts are as follows:

I took a strip of mica two diameters (7·8 inches) in length; and having coated one of the sides with lampblack, when it was quite dry I suspended it in a Coulomb's torsion balance, having previously electrified the metallic disk of the balance needle with positive electricity. The blackened side of the mica faced the electrified disk. When the needle had come to rest I allowed the radiations from a large gas flame to fall upon the blackened surface of the mica. Notwithstanding the light was at a considerable distance and had to penetrate the thick glass shade enclosing the balance, the needle was rapidly repelled several degrees, showing that the blackened face was positively electrified under the influence of radiation. I then turned the strip of mica so that the bright side faced the disk and allowed the radiation to fall as before, upon the blackened surface. This time the needle indicated an attraction between the disk and the mica, thus proving that the bright surface was negatively electrified.

To anticipate an objection to the theory of the radiometer which will be suggested by these facts, namely, that these electrical manifestations are too feeble to account for the rapid revolution of the arms, I made the following experiment: I rubbed the globe gently with a brush composed of fine threads of glass; the electricity developed on the globe, acting by induction upon the nearest mica disk, caused a brisk oscillation. I then measured the intensity of the electricity upon the glass globe by means of the proof plan and Böhnenberger's electroscope. There was no indication of greater intensity in this case than there was when the globe was electrified by the radiations from aluminous or obscure source and tested in the same manner.

From the above facts the following theory necessarily flows as a corollary; The hemisphere, A, being negatively electrified, as we have shown, upon its whole exterior surface, we justly conclude that the interior is positively electrified. The hemisphere, B, is electrified in the same way, but its intensity is different, the charge being less at B than at A.



The mica disk in the position, a, with its blackened side turned towards the radiant source, is electrified positively upon the black and negatively upon the bright surface, as we have proved above. As like electricities repel and unlike attract, the positive electricity at A will repel the arm, and that at B, acting upon the bright face, will attract it, so that it will necessarily rotate in the direction of the arrows, namely, A a B. When the arm has reached b, the direction of the rotation will not be changed, but A will now attract, and B repel, and it will continue to move in the direction B b A. The direct and most usual movement of the arms in Professor Crookes' radiometer is thus explained in the simplest manner. JOSEPH DELSAUX, S. J.

11 Rue des Recollets, Louvain, Belgium.

[For the Scientific American.]

NOTES ON THE RESISTANCE OF MATERIALS.

The ordinary formulæ and tables in technical works for proportioning the parts of machines and structures are based on the ultimate resistance of the material which is to be employed, accompanied by recommendations that a certain fraction only of the breaking load should be applied in practice. This fraction varies from ½ to ⅙, according to the views of different authorities. It has been found, however, that a material may be strained in such a manner as to become unsafe, by a load that is generally less than half the ultimate resistance, so that some of the best authorities consider that the fraction of the breaking load, or factor of safety, should be chosen with reference to the elastic limit of the material rather than its ultimate resistance. Still more recently, attention has been directed to experiments showing that materials could be ruptured by the repeated application of a comparatively small load. It is obvious that a rule for proportioning a machine, which provides for safety by using only a part of the strain allowed by the theory in which the rule is founded, is at best only a makeshift, and is unsatisfactory on many accounts. If the structures of the materials used in the arts were understood, so that the effect of strains could be accurately noted, it would of course be easy to give rules which would enable the material to be disposed in the most effective and economical manner. The experiments on the effect of repeated strains, referred to above, furnish some facts on which a novel and interesting theory of molecular structure has been based. Although this theory is far from being fully verified by experiment, it is, to say the least, not absolutely contradicted. A good discussion of the subject has recently been given by Professor Spangenberg of Germany, and a translation of the same has been published in this country, from which the following account has been condensed.

What is commonly regarded as a solid is supposed, in the theory referred to, to be made up of a number of atoms and molecules, surrounded by ethereal atmospheres, and grouped in various forms, according to the temperature and nature of external strains. Most readers know that the theory, so far, is in accordance with that generally adopted by scientists. Perhaps it neerv can be absolutely proved, although it has been shown to be extremely probable. Now it is known that when a mass of metal is melted and poured into a mold where it is rapidly cooled, it tends to crystallize in groups, and this is regarded as the first normal condition. Wrought iron and steel are generally rolled or hammered before use, and this breaks up the crystalline groups and produces a fibrous grain. When a metal is subject to strain, the grouping of the atoms will be changed, and they may return to their former position when the load is removed, or may take new forms, according to the amount of the strain and the rapidity of its recurrence. The effect of repeated strains is to break up the crystalline structure, and induce an amorphous condition. In changing to this state, the strain may act so quickly that all the crystals are not affected, and rupture will occur. The atoms of the body are supposed to have a mutual attraction for each other, and the other atoms attract those of the body and mutually repel each other.

It seems to be settled by experiment as well as theory that, contrary to general notions, the resistance to rupture of a body is less, the more crystalline is its structure, and increases as the amorphous structure is produced. It is supposed that the cohesion between separate crystalline groups is less than the cohesion of molecules forming a crystal.

The experiments given in connection with this theory show conclusively that the number and duration of strains are of quite as much importance as their magnitude. Whether then, the theory on which this action is explained is accepted or not, the facts seem to show the point to which future experiments on the strength of materials should be directed. Possibly the United States testing board may derive some hints from Professor Spangenburg's treatise.

R. H. B.

CHEMICALS AT THE CENTENNIAL.

THE FRENCH EXHIBIT.

The number of exhibitors is about the same as in the German department, but the exhibits taken together are less interesting, we think, than those of Germany. The want of a good French catalogue of their chemicals is severely felt. Beginning with the aniline colors, those of A. Poirrier, Paris,are particularly noticeable, both for quantity and color. One huge mass of *violet de Paris* (dimethylaniline violet) is over 2 feet long and 18 inches wide. Several of the aniline dyes are exhibited in glass fruit dishes, the foot of each dish being wrapped with silk dyed therewith, and exhibiting a striking manner the difference of color which these dyes have when dry or in solution, as most of the reds and violets form green crystals. This seems due to the fact, equally difficult of explanation, that they reflect one color and transmit another, wherefore solution and films are red, thick masses and crystals green or bronze. In addition to several aniline colors, so called, this firm exhibits the new and costly eosine in larger quantity than almost any one else. Also specimens of benzyl chloride and benzoic acid made from the latter, as well as benzyl anilin. This exhibit is unequaled except in the German department, where Bayer & Co. and the Berlin Joint Stock Company compete for the first place. Some large blocks of corallin, anilin red, etc., are exhibited by Guinon's Sons & Co., Lyons, as also orzulin, cochineal, picric acid, and bisulphite of soda. Clauseau exhibits madder root, whole, in powder, and flour, alizarine and purpurine from madder, alcohol from madder, and madder extracts. A. Beslier exhibits the whole plant of *thapsia garganica.* Several parties exhibits dye woods and extracts used in dyeing. Charles Dubois exhibits a number of cyanides and other poisonous salts for use in the navy, probably as wood preservers, including cyanides of lead and copper, sulphocyanides of mercury, copper, and arsenic, chromate and arsenite of mercury, etc.

Solvay & Co. exhibit both here and in the Belgian section a set of substances to illustrate their new ammonia soda process, namely, salt water, crude ammonia liquor, carbonate and bicarbonate of soda. The analyses show the extraordinary purity of the soda obtained in this process. The carbonate of soda contains 99·438 per cent of the pure salt, ($Na_2 CO_3$), 0·21 of common salt (Na Cl), 0·0015 of sesquioxide of iron. The bicarbonate is, of course, less pure, containing bicarbonate of ammonia to the amount of 0·42 per cent, which is expelled along with the extra equivalent of carbonic acid, on heating to form the monocarbonate. Photographs of the exterior of the works are shown.

The most interesting pharmaceutical exhibit is that of C. Torchon, Paris, containing a huge block of chloral hydrate, ditto in crystals, a whole guinea pig preserved by the injection of chloral, specimens of hydrosulphide of chloral, metachloral, and alcoholate of chloral. In the same case is a bottle of petroleum said to have been produced synthetically, by the action of carbonic acid and steam on sulphide of iron.

There are, indeed, many soap and candle exhibits, a few carbolic acid exhibits, sulphur in several forms, capsules and pills, insect powder, glue, gelatin, and bone black; but little of real interest to the chemist. Of ultramarine we noticed but two exhibits, those of F. Richter, of Lille, and Guimet, of Lyons. Faure and Kessler's pan apparatus for concentrating sulphuric acid is also to be seen in this section.

THE BELGIAN EXHIBIT.

One of the most interesting objects in the Belgian section is a working drawing (elevation) about 6 feet long, illustrat- A. De Hemptinné's new method of making and concentrating sulphuric acid. We think this process has not been tried on a manufacturing scale, but it is attracting more attention at this moment, among practical men, than any other novelty in this important industry. Solvay & Co., Couillet, near Charleroi, have a better exhibit of the ammonia soda process here than in the French section above referred to. The other exhibits are unimportant, excepting the coal tar colors of Max Singer.

THE SWISS EXHIBIT.

Bindschedler & Busch, of Basle, deserve notice for their coal tar products, which include some remarkably large needles of crystallized anhydrous phtalic acid, diphenylamine, artificial alizarine, crystals of anthraquinone, resorcin, toluidine, eosine, and ether of tetrabrom-fluorescene, which latter is the correct scientific designation of the beautiful eosine already mentioned. A manufacturer of coffee substitutes, fig coffee, vanilla coffee, etc., makes quite a display here, as does Hurlimann, who shows artificial Swiss honey. We also noticed several specimens of phosphorus bronze, which are interesting, although not strictly chemical.

HOLLAND.

The Netherlands are poorly represented in this department; even coal tar colors are absent, and soaps, oils, glass, inks, and paints, with one large pyramid of crude sulphate of ammonia, exhaust the list. One case contains a fair show of minerals, including a large mass of malachite, and smaller pieces of amethyst, *lapis lazuli*, and labradorite (locality not given). Von Ketten exhibits a powerful horse-shoe magnet, composed of seven leaves; it is 2½ feet long, weighs 83 lbs., and will lift, he says, 500 lbs. A series of models illustrating in detail the effects of the cattle plague were of particular interest, as showing the care with which this subject has been studied abroad.

SWEDEN.

The land of Berzelius is largely given up to "match-making," if we may judge from the catalogue, where no less than 16 out of the 37 exhibitors deal wholly in safety matches. Norway sends over but five match makers. The well known safety match of the Jönköping's Company occupies a beautiful case, where we find matches, pocket match safes, igniting surfaces, and a new double safety match, which it is said ignites only on the box, and becomes entirely dead instantly the flame is extinguished. In the neighborhood of this famous case are columns covered with matches, with candles, and with aseptine, for the preservation of provisions and animal material. Bengston exhibits some soda and Glauber salts,and Werner some bone oil, in little flasks tastefully suspended to circular rings in tree form. Kimtze & Co. exhibit several water filters, and Almén a variety of medicated gelatin. The celebrated Swedish filter paper, the only paper used in quantitative chemical analysis, is exhibited by the Grysckbo Factory at Falun. The same firm exhibit writing, drawing, and printing paper, with a copy of Berzelius' commendatory notice of their filter paper. We saw no filter paper elsewhere in the exhibition, but we believe that Germany is now in close competition with Sweden in that line.

AUSTRIA.

We were disappointed to find that Austria had not thought it worth her while to send over anything but soap and candles. Ozokerite, or mineral wax, seems to be the staple production of certain parts of Austria, Gallicia more especially, and all the changes are rung on this one substance to the exclusion of more interesting products. F. A. Sarg, Son, & Co., Liesing, near Vienna, have a large white tablet, nearly 20 feet long and perhaps 12 feet high, made of blocks of stearine with a yellow border of wax, and their name and place of business in large letters upon it. This firm exhibits oleomargarin, milly candles, and candles of paraffin and ozokerite, an interesting collection of fatty acids both solid and liquid, glycerin, wax, etc. Another handsome display is that H. Ujhely & Co., Stockerau, fancy wax in great variety. G. Wagemann exhibits refined mineral wax and petroleum; and Paul Dobel, Boryslaw, Gallicia, exhibits the crude ozokerite in its natural state as well as the melted and refined article.

More of a truly chemical nature is the exhibit of anthracene, alizarine, sulphanthraquinone, and its sodium salt, by Przibram & Co., Vienna.

The royal-imperial director of the Idrian mines sends a set of minerals and products such as cinnabar,uranate of sodium, potassium, and ammonia, oxide of uranium, and the like.

Chemical glassware of the latest and best forms is sent by Lenoir & Forster. Small sets of chemical and physical apparatus for national schools comes from A. Kreidl, Prague. The entire collection consists of 76 different articles and reagents, and costs, including packing, 53 Austrian florins (about $26) in Prague. This complete set, as the circular calls it, seemed to us quite incomplete, and, like most little sets of this kind, almost useless either for the instructor or learner. The general display of Bohemian glass ware, of course, is extremely elegant; but a description of it would out of place here

In an out-of-the way corner is a small horizontal case, occupying scarcely two square feet of space, and seldom noticed by the visitors, containing a new kind of confectionery, exhibited by Josef Gobetzky, Essegg. It differs from most articles of this nature in that it contains a tasteless salt of quinine, said to be the tannate. It is probably the same as those made by Rozsnay, in Arad, and described and endorsed by Dr. H. Hager in his *Pharmaceutisches Centralhalle.* The latter analyzed them and found that each lozenge contained 0·97 grain of hydrate of quinine in the form of tannate. The chocolate pastilles contain about 0·93 grain of hydrate of quinine. If they are really all that is claimed for them, tasteless and yet therapeutic, we hope to see them introduced here.

ENGLAND.

Like those of the Austrian section, the English chemicals deserve but brief notice. Soda ash is the staple, and all the possible changes are rung on it, nor are we surprised at this, for this is England's leading industry. Some firms send over chloride of calcium, sulphur, and starch; one firm sends a bust of Linclon made of ozokerite. The Price Candle Com pany exhibit a large number of photographs of the fatty acids, showing the effect of admixture with varying quantities of other acids or of paraffin. Dr. Siemens exhibits a model of his regenerative gas furnace. Some beautiful irides-cent crystals of chlorate of potash are shown by the Greenbank Alkali Company. The finest display of rarer chemicals is that of T. & H. Smith, which, like many others, are not down in the official catalogue. They exhibit a large cake of caffeine, and smaller quantities of codeia, cryptopia, apomorphia, muriate of thebaia, citrate of caffeine, other rare alkaloids, and thebolactic acid, an acid discovered by Messrs. Smith and obtained by them from the mother liquors of morphine. It is possible that it is really nothing but ordinary lactic acid.

Importance of Well Seasoned Timber for Carriage Building.

Lumber for bodies and gearings, including ash and poplar for the former, and hickory for the latter, to be properly seasoned should be nicely piled in the shade, and protected from exposure to wet weather. The cross slats between the boards should not exceed four feet in distance apart, so as to prevent the boards from warping out of their original shape.

Boards, as a general thing, check in at the ends, very often several inches, and sometimes a foot or more. and, of course, the lumber at that part is thereby rendered unfit for use. But to prevent this being a serious difficulty, it is simply necessary to place the end slats as close to the edge of the end as possible. Now, it is very obvious that moisture will be retained at the slats more than on the naked parts of boards; the result is that the boards do not shrink so rapidly at the slats as they do away from them; and consequently the boards remain whole and do not become wavy.

It is said by those who profess to know something about wood that, if you set timber upon one end, it will season quicker than it will if laid down. That is very likely so, and if so it may be caused by the fact that the sap or matter ejected ascends through the pores of wood set upon one end, without any hindrance, while it could not so readily if laid down. It is seen that fibers of the wood are longitudinal connections, and all the substance to be ejected collects between these connections in the pores, running from one end of the wood to the other, and flows out in the same direction. That is why the transverse expansion or swelling of wood is great, while its increase in length is hardly perceptible, when the pores absorb water.

Bodies, to be durable, should have the stuff in them highly seasoned, but not have it cooked too much by suspending it over a stove, so as to deprive it of the requisite substance and render it brittle. Cooking panels, as just described, brings them in such a condition that it is impossible almost to get them solidly glued on the frame without checking them at the ends, and at the same time they are liable to be split in two.

All that panels require after they are thoroughly seasoned, after fastening them to the frame, is to take out the dampness by warming them; and the frame does not need anything more. But proper seasoning is a requisite.

No matter how well developed constructiveness may be in a body maker, or the other faculties that aid him, or how experienced a mechanic he may be, even if he can make bodies without any person being able to discover the trace of a joint, if the stuff is not seasoned before it is put together, the body will not, cannot, stand.—*J. W. Daron, in the Hub.*

THE AMERICAN SOCIAL SCIENCE ASSOCIATION.

A largely attended meeting of this body took place at Saratoga, N. Y., during the week ending September 9, and many papers of value and importance were read. Among the most prominent was one by Mr. Edward Atkinson, of Boston, Mass., on

THE RELATION OF CAPITAL TO ANNUAL PRODUCTION AND SUBSISTENCE.

He commented on the outcry for cheaper transportation by stating that 500 lbs. of meat and grain constitute the full subsistence of an adult man for one year, and it cost to-day but $1.25 to move a quarter of a tun or 500 lbs. from Chicago to Boston, less than one day's wages of a good mechanic. In this low cost it would be difficult to find evidence of the rapacity of the railway monopolists. So far as the people of Massachusetts eat bakers' bread, it costs them more to move the bread from the bakers' oven to the mouth of the consumer than it does to move the flour from the wheat field to the oven. There are, doubtless, grave defects in our railway system, but the fact must not be ignored that those special corporations, against which the most urgent charges of monopoly have been made, are the ones that do the most service in distributing the largest quantity of product at the least relative cost to the community.

The remainder of Mr. Atkinson's paper, which was too long for publication *in extenso*, was chiefly devoted to the capital and labor question; and it closed with a vigorous attack on the greenback form of money.

Mr. H. R. Hayden read a paper on

LIFE INSURANCE AS A SOCIAL FORCE,

in which he pointed out that a sound system of insurance effects a distribution of the loss which afflicts relatives when premature death occurs, and which averages human life as far as the well-being of the survivors is concerned. He complained of the laws affecting insurance in many of the States, stating that they gave advantages to the dishonest and so destroyed public confidence.

Mr. Nordhoff read a paper on

THE INDUSTRIAL AND SOCIAL CONDITION OF THE SOUTH.

a question which can hardly just now be kept clear of politics; and Mr. Nordhoff's essay dealt chiefly with the subject as it shows the difference between republican and democratic misgovernment.

Professor Dwight read a paper on

LEGAL EDUCATION IN THE UNITED STATES,

in which he contrasted the position of the lawyer in this country with his *status* in England. In the latter country, the lawyer confines himself to one branch of the profession, and obtains an accurate though limited knowledge; but here the lawyer prepares himself in each department of professional labor, and obtains breadth and comprehensiveness at the cost of precision and accuracy. He furthermore advocated reforms in the system of college examinations, and an increase in the opportunities for students to acquire sound learning and a high sense of professional honor.

CLEANING BRASS INLAID WORK.—Mix tripoli and linseed oil, and dip felt into the preparation. With this polish. If the wood be rosewood or ebony, polish it with finely powdered elder ashes, or make a polishing paste of rotten stone, a pinch of starch, sweet oil, and oxalic acid, mixed with water.

A NEW STEAM ENGINE.

Messrs. Eli James Smith and Benajah Mason, Jr., of North English, Iowa, are the inventors of the novel steam engine herewith illustrated, which was patented through the Scientific American Patent Agency, August 1, 1876. The cylinder consists of two flanged sections, which are bolted to a central partition, C. A valve, *a*, is placed in a slot cut in the head, C, and is pivoted at *b*. D D are pistons, which are placed upon a piston rod, E, the distance between them being a little more than the length of the stroke and the thickness of the central head combined. The valve, *a*, is enlarged above the pivot, *b*, so as to engage with the bosses on the pistons, D D, at the end of every stroke, being moved by each piston in alternation, opening the supply passage, *c*, and the exhaust passage, *d*. The lower end of the valve is continued outside of the cylinder, and formed into a handle at *e*. The cylinder, A, is mounted on suitable supports, and the piston rod, E, is connected with a crank and fly wheel in the ordinary way.

Steam is taken through a pipe, F, and through the open port, forcing the piston away from the central head, the piston remote from the head following, of course, until it strikes the enlarged portion of the valve, throwing the valve over, and allowing the steam to enter on the other side of the central head, forcing the piston toward the end of its stroke. At the same time the lower part of the valve opens the exhaust port, allowing the steam to escape through the passage, *d*. If it is desired to reverse the engine, it is only necessary to move the valve, by means of the handle, *e*, at the proper instant, when steam will be admitted on what was before the exhaust side of the central head. When the engine is made vertical the upper section of the cylinder is made a little larger than the lower one, to compensate for the weight of the pistons.

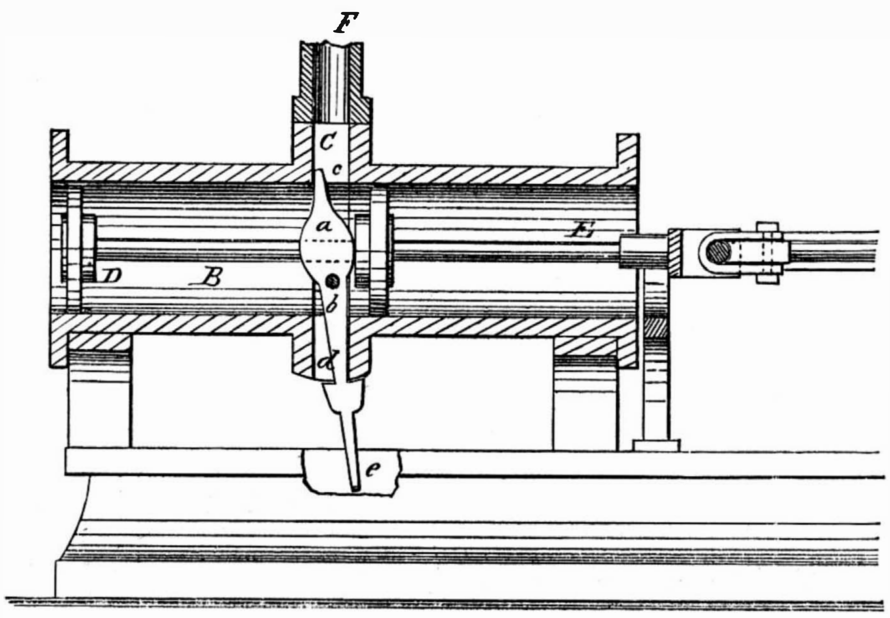
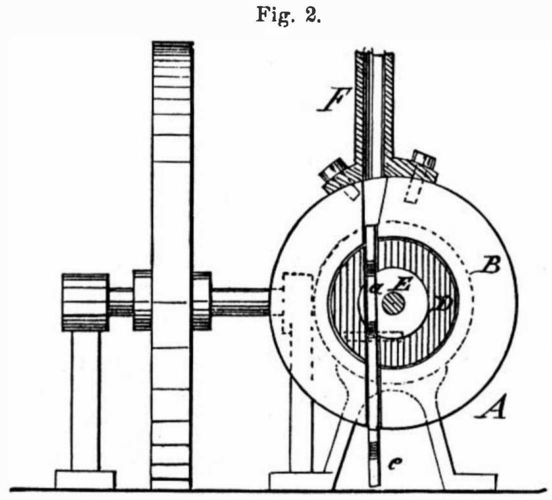


Fig. 1.—SMITH & MASON'S STEAM ENGINE.

Fig. 2.



THE ORIGINAL STEAM STEERING APPARATUS.

It is very rarely that any invention survives a period of half a dozen years without being made the subject of so many improvements and modifications that, in the end, it often happens that little or none of the original device remains. We know of no exception to this rule more remarkable than that of the steam steering apparatus in which steam, for the first time, was used to operate the rudder of a vessel This machine, in its present form, is practically identical in operation with the first tangible outcome of the inventor's thought. The lapse of 25 years has worked no notable change in its mechanism; and the first apparatus of the kind ever built—an engraving of which as it appears at the Centennial Exposition is given herewith—compares in every way favorably with those of most recent construction, despite the fact that the latter embody mechanical refinements not found in the early model.

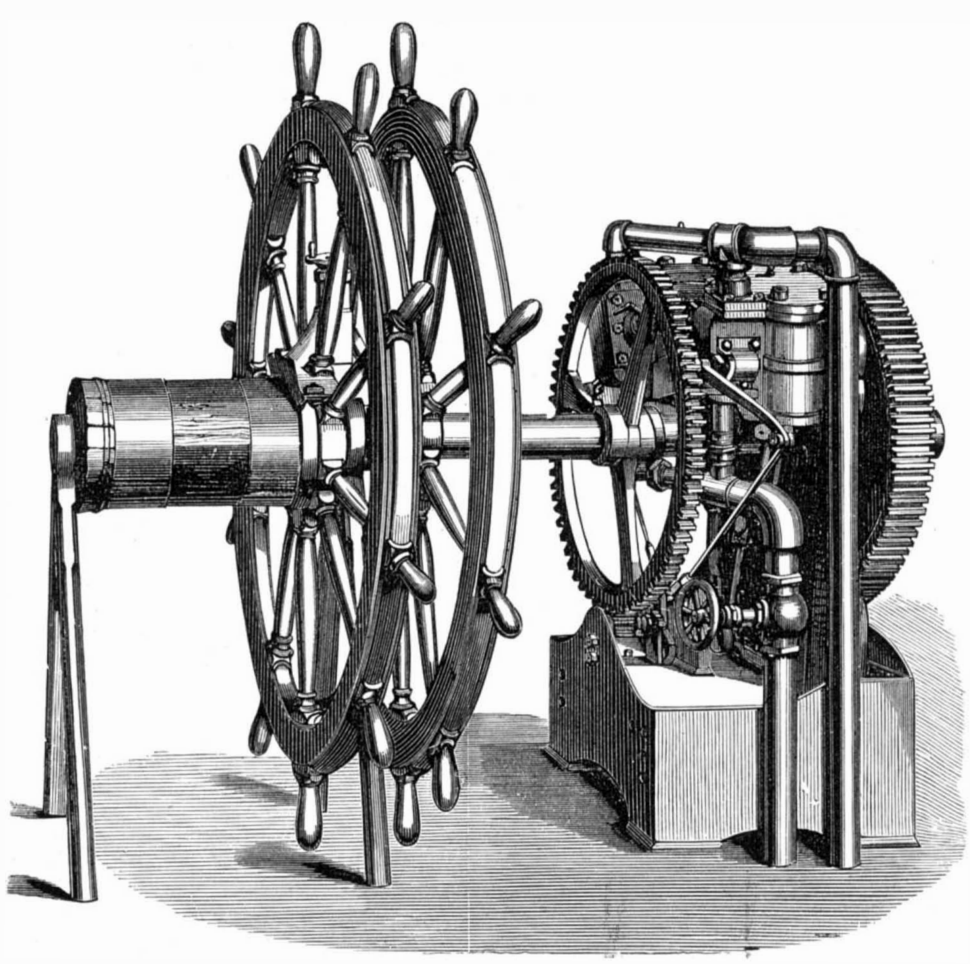
The inventor of this edvice, the importance of which is now recognized the world over, is Mr. Frederick E. Sickels, already one of the most famous of American inventors through his origination of the well known Sickels cut-off. The control of the rudder is secured by operating the valves for the admission of steam to the cylinders by a hand wheel. The rudder is thus compelled to follow the motion of said wheel, which is similar in form and mode of operation to the ordinary helm. Suitable disconnecting and connecting gear is provided, whereby the steam apparatus can be thrown out of action and the helm worked by hand in the usual way.

Apart from its serving as evidence of the non-alteration of the device from its original form, the apparatus at the Exposition is obviously possessed of much historical interest. It was used by negro pilots in the South previous to the war without the slightest failure in its operation; then it was exhibited in the Crystal Palace, in this city, in 1853–4. It was next put aboard the steamer Augusta, running between Savannah and Fernandina, on a route extremely difficult of navigation by single engine steamers on account of crooked channels. It was, when thus located, submitted to the severe tests of heavy gales and rough seas, with out any impairment of its efficiency taking place. When the war broke out, the Augusta was brought to New York, and the machine was removed and sent to the London International Exhibition of 1862. There it attracted great attention, and a medal was awarded it; and from this time the machine, of which it is the prototype, has gradually been creeping into use.

A model which is exhibited at the Centennial beside the large machine, Mr. Sickels states, is prior in date to any attempt, in books, drawings, or models, to devise a power-steering apparatus. It appears further that Mr. Sickels first began experimenting upon the subject as early as 1847.

During the present year the invention has been tested by a board of naval officers, and its adoption in the United States naval service strongly recommended. It has already been adopted in the English navy, and is employed on nearly all the British merchant steamers which enter the port of New York. From the owners of these last the inventor receives no royalty, nor do the former in anywise make return for the benefits they enjoy, preferring to avoid doing so by taking advantage of the fact of these vessels being under a foreign flag.

Those visitors to the Centennial, who may make an interesting study of the original machine, will be enabled to judge of the absence of improvements and the perfection of the original model by comparing it with a recently constructed and finely made apparatus of the same description exhibited by the government in the United States building. To the student of the rise and progress of American invention we can suggest no more profitable expenditure, of a part of the time devoted to the examination of the Centennial Exposition, than in making just such studies as this. There are other original machines—notably a model of the first sewing machine made by Saint in the last century, beside Elias Howe's original device—which would form profitable subjects for further examination of the same nature.



THE SICKELS STEAM STEERING APPARATUS AT THE EXHIBITION.

A Plea for Inventors.

Of all the mental efforts requiring imaginative construction, none is more difficult than that which is required to develope a new mechanical movement, or originate a new plan-mode or mechanical principle. The faculty of inventing depends more upon natural endowments, or rather instinctive intelligence, than upon education and experience. Experience only serves to familiarize the inventor with the wants or deficiencies in any particular line of industry, and education assists in giving completeness to the conception; but the conception itself is a matter entirely independent of either, and is just as apt to be suggested by an illiterate and inexperienced person as by one who has spent years in studying and investigating the matter: in fact more so, because education and experience are both the results of study and long familiarity with existing devices, so that they, to a certain extent, incapacitate their possessors from looking beyond the boundary of their experience and teaching. Upon the principle that "fools rush in where angels fear to tread," the illiterate inventor will investigate methods and plans which many an experienced artisan or workman would not entertain for a moment, simply because they do not possess that imaginative construction necessary to give the new creation mental existence, and because their teaching and experience do not include the new idea. Thus many of our most important and most novel inventions have been originated and developed by persons entirely devoid of technical knowledge and experience in the field of mechanics to which their inventions belong. Accident, circumstance, and necessity all contribute to the discovery of new principles. Sometimes, however, we find the skilled and educated mechanic possessed of the inventive faculty, and when this is the case he proves a "world mover." Such was Ericsson, who did more to develope the engine and strengthen the navies of the world than all other inventors combined. Such was Morse, who, with a skill and learning which was admirable in its completeness, adapted and perfected the telegraphic system with such precision and judgment that today it retains the principal features that he gave it. Such were Hoe and Colt, and other inventors whose memories the civilized world hold in reverence.

All patents are not productive, neither are all farms; all men are not rich; all mines are not bonanzas; but if we were to strike a balance sheet we would find that the proportion of the profitable and unprofitable patents correspond in a like ratio with the other profitable and unprofitable enterprises which men undertake.

When we consider the vast number of patented articles in the market, many of which are covered by a number of patents, we will realize that the work of the inventor is very often profitable. There is scarcely an article of human convenience or necessity in the market today, that has not at sometime or other been the subject of a patent, either in whole or in part. The sale of every such article yields the inventor a profit. If we purchase a box of paper collars, a portion of the price goes to the inventor; if we buy a sewing machine, the chances are that we pay a royalty to as many as a dozen or fifteen inventors at once. Indeed the field is so vast and the number of profitable patents so great that it would be far preferable to undertake a recapitulation of those patents which are not profitable than those which are.

The universal sentiment is that genius is its own reward; and in order to give effectiveness to the sentiment, the person who possesses genius in any branch of industry is allowed to set his own price upon the result of his labors. It is therefore but a just recognition of the services of the inventor that he be allowed to provide for his own wants from the benefits which he confers upon the public. The artist who produces a picture of unusual merit can find purchasers for it at a fabulous price. The stage actor who can draw crowded houses can demand and receive for a single performance what would be a year's salary for an ordinary workman; and the lawyer that possesses the faculty of swaying the minds of a jury by his eloquence can demand and receive whatever sum of money he desires for his services; yet the labors of the inventor yield more substantial results, and benefit mankind more than all these combined. He is the sapper and miner who prepares the way and overcomes all our mechanical difficulties; in fact, he furnishes us with the honey, while we are the drones in the hive that derive benefit from his labors. Give credit; then, where credit is due. The inventor is the world's benefactor, and as such we take off our hat to him.—*Mining and Scientific Press.*

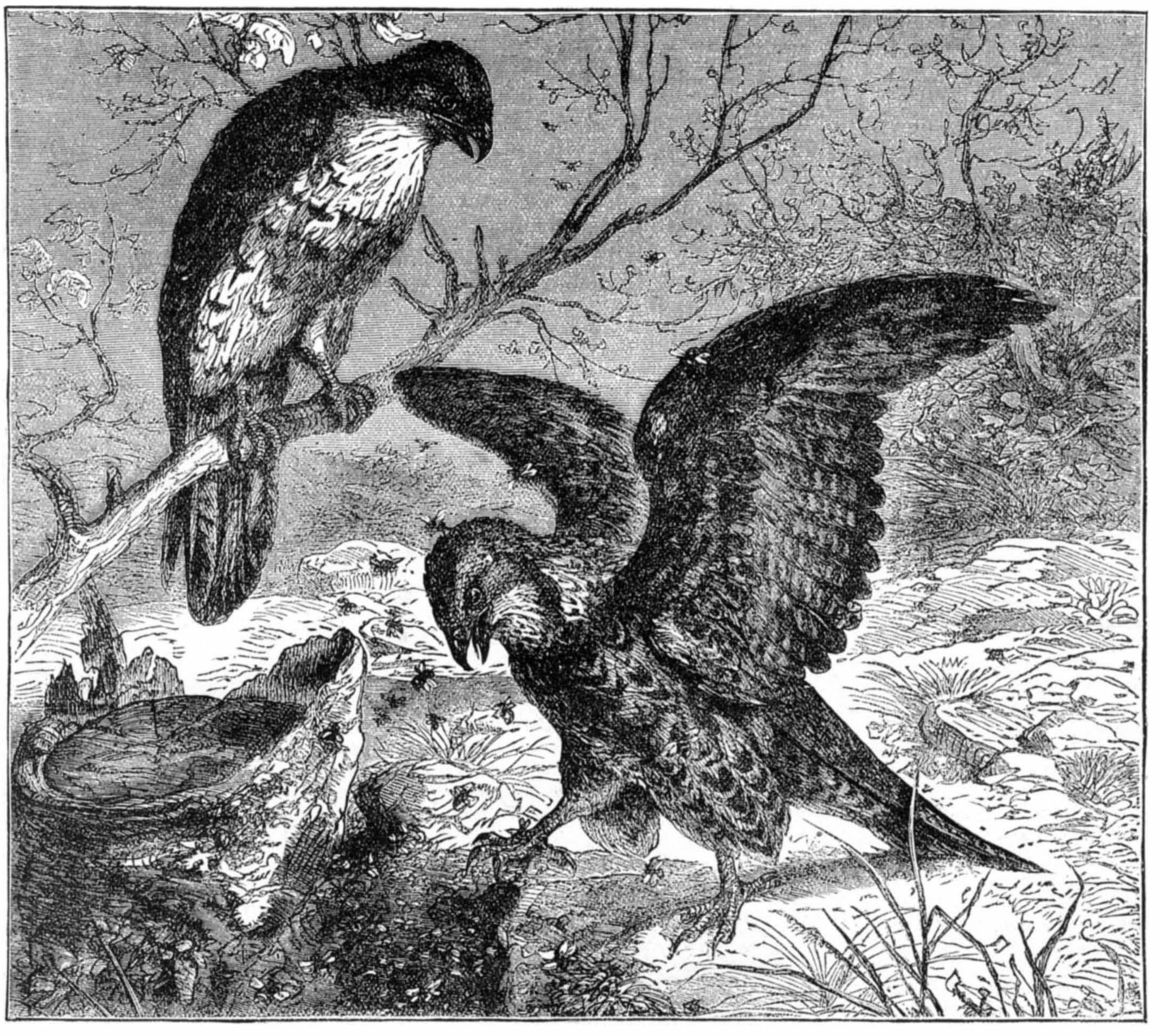
Oil of Orris Root.

Orris root owes its use during more than two thousand years chiefly to its fragrance, which, curiously enough, does not belong to the living root. Its slight and by no means aromatic smell is first developed into the agreeable perfume after drying, without doubt in consequence of changes of a chemical nature, concerning which at present our knowledge is deficient. When the dried root stock is submitted to distillation with water, eventually there appears upon the water a crystalline odorous matter, which is justly prized in perfumery and is specially prepared by some of the larger distillers. But the yield is very small, only about 1 part per 1000 of the orris root used. The product is of a yellowish brown color, of the consistence of a firm ointment, and possesses the characteristic odor of orris root.

THE HONEY BUZZARD.

The honey buzzard is one of the *falconidæ* or hawks, and is known to natural historians both as *falco pernis* (*Cuvier*) and *falco apivorus* (Linnæus). It is known throughout Europe; and specimens with a wing measurement of 50 inches are on record, but commonly 20 or 23 inches is the extreme width from tip to tip. The head is always gray, and the eyes, as well as the feet, are yellow. The talons, bill, and cere are black. The plumage on the upper portion of the body is brown; beneath, brown and white mingle indiscriminately, while the tail, which is long, is marked with transverse ash-colored bars; the toes are only half feathered. In the female the plumage is similar in color, only very decisively spotted.

The honey buzzard breeds in trees; the eggs are two in number, color gray, with obscure spots. An egg collector came across a nest of one of these birds while in pursuit of his hobby at Selborne, England. In the nest he found but one egg, which was much smaller than that of the *falco apivorus*, not so round, and dotted at each end with small red spots, being surrounded in the center with a broad blood-marked zone.



HONEY BUZZARDS AND THEIR PREY.

It must not be supposed that the food of these birds is restricted to honey, which only forms its dessert; but they devote attention to small birds, insects, and reptiles, as well as "rats and mice, and such small deer," and have been known, says a writer in the *Young Fancier's Guide*, from the pages of which we select the engraving, to purloin the eggs of other birds.

A Curiosity in the Baltimore Record Office.

In the course of the examination of titles in the record office to the ground comprised in Federal Hill Park, which will involve a good deal of labor yet before completion, Mr. Warfield T. Browning (assisting the city examiner, Mr. Henisler) yesterday came upon a deed which excited remark among the persons in the office for some curious matters referred to in it. The paper is a deed of trust in the nature of a will from Dr. John James Giraud, who resided on South street, and owned a part of the Federal Hill ground, conveying all his property to John S. Tyson in trust for the wife, heirs, and legatees, of Dr. Giraud. The deed was executed March 16, 1826, but Dr. Giraud did not die until 1837. Among the legatees was Right Rev. Ambrose Marechal, Archbishop of Baltimore, for several thousand dollars, and the trustees of the poor of the city and county. Among the bequests are two patents, dated January and April, 1821, to Dr. Giraud for "a discovery in mechanism, consisting of a very simple machine of considerable power, for the use of steamboats and other machinery requiring the application of great power. The patent is termed the handle or cylindrical machine, and the machine carries in itself its fulcrum or point of support." He also bequeaths his right in a discovery of a specific or medicine for the prevention or cure of yellow fever, plague, and malignant and pestilential fevers. The deed says its eminent virtues have been proved by three years of operation and trial by order of the government and medical faculty of Havana. Dr. Giraud's memoir on this subject was published in 1825 by William Wooddy, Baltimore. The specific consists of two liquors, limpid, tasteless, and inodorous; they are neither purgative nor emetic, but recall the secretions through the proper emunctories, and the crisis takes place by perspiration, etc.

The composition of the liquors, he says, cannot be discovered by chemical analysis, and their discovery was the result of the study and labors of one third of his lifetime. The government at Havana was to have given him, the deed states, $120,000 for the discovery; but the commotions in Spain and the death of Governor General Mahy interrupted the negotiations. He says he desires the secret to be sold by the trustees for his heirs to some government, and for that purpose, for the first time, writes down the composition of the recipe. Should any other person, as is not impossible in this age of science and chicanery, be found possessed of the recipe he is to be treated as a fraud, and the trustee is authorized "to prosecute him with all the rigor of the law." The doctor estimated the amount to be realized from the sale of his patents at $60,000, and directs that out of that sum $6,000 shall go to the archbishop and $3,000 to the poor. His sanguine dreams of profit from this source were not realized, however, no government being found to purchase the patent for the specific; and now the missing ingredient is the money that was expected.—*Baltimore Sun.*

The Care of Machinery no Mystery.

The *Mill Stone*, a monthly journal published at Indianopolis, Ind., one of the many good papers printed in the interest of special trades at the West, gives to its readers the following sound advice on the watchful care necessary in operating machinery:

To correctly plan and devise improvements in machinery involves the exercise of a considerable degree of original genius; and to fully develop such improvements, and to bring them into the most practical shape, requires, in addition to this, the application of acquired knowledge of the construction of the machine or mechanical combination, in such manner that each of the different parts thereof may be properly proportioned and arranged with reference to the particular function which it is designed to fulfil. When this is done, and the work completed, its useful mission has commenced, and inventive talent or skillful instructors need not be employed upon it, unless it should be to modify or add further improvements. Yet, however complete in itself, or however effectually it may perform its work, it is not endowed with the faculty of self-preservation, and, unless it be properly cared for, will be subject to numberless accidents and injuries, involving not only its own immediate or ultimate destruction, but, in many instances, the loss of life or limb to those employed in its operation. This necessary care requires, not the expert mechanic or professional skill, but simply the exercise of common sense. It is by prompt attention to little things that the maximum efficiency and durability is attained, with properly designed and constructed machinery. When the bearings of shafts and the spindles are not oiled sufficiently, not only does the increased friction require a greater amount of driving power, but the bearings are roughened or destroyed in a proportionate degree. When the caps of journal boxes are left too loose, the journal wabbles, and, if there is gearing attached to the shaft, its teeth are badly worn out of shape; while, if the caps are screwed down too tight, the oil is forced out, the journal heats, and both the shaft and bearing are soon rendered worthless. These matters are of no small moment, and the aggregate loss resulting from inattention to them is very great. It is not confined alone to the machinery of mills and other manufacturing operations, but occurs in a very much greater degree in machinery employed in agriculture. Many a thrasher, horse power, or harvester has been branded of bad construction, and been prematurely disabled, when a few drops of oil, or one or two turns of the wrench, were all that were required to set things to rights. Many other items might be mentioned, in which attention to little details, requiring only an application of ordinary common sense, will guard against great and unnecessary waste of power and damage to machinery; but these are sufficient to illustrate the almost self-evident proposition that, while talent is required to originate, and practical knowledge to construct machinery, its most efficient operation, and the profit in its use resulting therefrom, can only be secured by bringing to bear upon its management the plain, ordinary principles derived from every day observation and experience.

Etching on Glass.

M. E. Seigwart has lately given some interesting particulars about etching upon glass.

Since fluoric preparations have been produced at reasonable prices, the decoration of glass by their means has steadily made its way. Etched glass is now to be found everywhere, and glass etching runs glass cutting very hard. It is very easy to understand that well etched objects appear actually more beautiful than those which have been cut. The cost of production is cheaper; and since M. Hock, a Viennese chemist, has given us an elaborate work upon the technics of glass etching, the difficulties attending this kind of work have been reduced to a minimum.

As is well known, fluoric acid usually etches smooth, while other fluoric preparations yield a matt surface. The most beautiful ornamentation is obtained when certain parts of the glass surface are rendered matt by means of fluoride of ammonium which has been slightly acidified by means of acetic acid. The matt appearance is not always the same with different kinds of glass, but varies much in beauty;

this effect is governed by the composition of the glass, lead glasses being easily acted upon, and furnishing a very fine matt surface.

Where it is desired to have the surface of the glass not altogether matt, but shining like ice, as in the case of window glass, this may be attained in a simple manner by placing the glass plate in a perfectly horizontal position and covering it with fine groats. Then very dilute fluoric acid is poured upon it. The groats act as a shield, and produce upon the glass raised points.

Several ways exist of etching photographs on glass. A good result may be secured by covering the surface with a solution of gum made sensitive with bichromate of potash, and printing the same under a negative; after the image has been thus produced, it is dusted over with minium or red lead, and the red picture thus obtained is fixed and burnt in in the usual manner. The easily soluble red glass, so obtained, is treated with strong sulphuric acid, when a white matt design is produced, and the picture appears by transmitted light as a positive.—*Photographisches Archiv.*

Power of Wooden Vessels to Withstand Pressure.

We have lately received a communication from a correspondent at Dayton, O., referring to an unfortunate occurrence, which caused the instant death of one man, and the narrow escape of several others. It seems that a number of men, in the employ of a manufacturer of artificial mineral waters, were in the act of charging a quantity of water, contained in a large iron-bound oaken cask, with carbonic acid gas, at a pressure of 130 lbs. to the inch. The cask, without any previous warning, exploded, with the results above stated. The explosion was sufficiently severe to splinter the cask and the three-inch planking over head. That such accidents are not of more frequent occurrence is to be wondered at; and under such circumstances we cannot but consider the employment of such vessels criminal. We have often cautioned persons against employing wooden casks for this and similar purposes; as it is evident from their construction that, under such conditions of pressure, the whole strain must come upon the hoops and binding clamps, which, unless of extreme strength, could not be expected to withstand such strain as they were placed under in the above instance. Besides, such vessels are always of doubtful efficacy for such purposes, for, where they hold liquids under pressure, even provided it were possible to render every joint tight, the liquid would gradually ooze through the pores of the wood; and if it so happened, as in the instance above cited, that the liquids contained a free acid, the metal bindings would speedily become corroded and weakened, thus rendering rupture, in time, certain.

Should personal and public safety be sacrificed to the mere question of economy? And is the incurring of such risks justifiable by the small advantages derived therefrom? Before more of such deplorable accidents as the one here recorded have occurred, it is to be hoped that the proper authorities will take the matter in hand, and prevent further loss of life from such criminal practices.

The World's Age.

Mr. William Chambers, the veteran author and publisher of *Chambers Journal*, contributes to that excellent periodical a summary of some of the many views held by scientists as to the antiquity of our world. The *Quarterly Review* treated the same subject recently, and that most conservative of magazines now admits that the ordinary interpretation of the date of the creation, about 6,000 years ago, is to be set aside as untenable and at variance not only with historic and archæological research, but with the substantial discoveries of geology. The reviewer quotes the opinion that it is impossible that the earth can have existed many millions of years, as the earth is cooling, if not rapidly, at such a rate as to make such an antiquity impossible; and again, there is reason to believe that the earth's rotation is not so rapid as formerly.

The question as to the date of creation must be considered to refer to our solar system alone. The nearest fixed star or sun outside our system—possiby the center of a similar system—is too far off to enter into the question of the age of our sun and its planets and their satellites, being two hundred millions of millions miles away. Sir Charles Lyell gives the date of the Cambrian formation of rocks as at least two hundred and forty millions years ago; while Mr. Darwin assigns to the world a much greater age even than this. Mr. Adams has essayed to calculate the retardation of the earth by the friction of the tidal waves on the atmosphere; and in conjunction with Professor Tait and Sir William Thomson, he allows 22 seconds per century as the time lost by the slackened speed. Mr. Chambers wisely concludes his article as follows: "We can only say that the theories propounded are eminently suggestive, but nothing more. It is not remarkable that there should be differences of opinion among men of science concerning the dark and stupendous questions of the cosmogony of the world. All we deprecate, in the present state of human knowledge, is rash dogmatising, one way or another."

The Poughkeepsie Bridge.

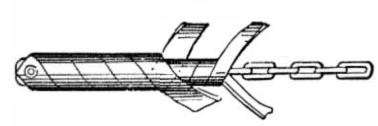
Progress is being made in the construction of the bridge across the Hudson river at Poughkeepsie, a work, which, when completed, will increase the facilities of travel between Pennsylvania and New England. The coal traffic alone, it is anticipated, will bring in a large revenue to the bridge, as the freight to Massachusetts and other manufacturing States will be considerably reduced.

The American Bridge Company is to construct the bridge and its approaches, and the materials for the first caisson are now being delivered. There will be four piers in the river, built on caissons, the foundation of which will be 85 feet below the surface of the water. The piers will be 525 feet apart, and will be built up of masonry to 130 feet above high water mark. The bridge is to have a double railroad track, a wagon roadway, and a way for foot passengers. It is stated that the Erie railway can cross the Hudson by this bridge and enter New York city, making a *détour* of only 10 miles from its present route, which has the disadvantage of landing its passengers in Jersey City.

CHAIN GEAR AND FASTENINGS.

Our extracts this week from Knight's "New Mechanical Dictionary"* include a series of engravings relating to chain, together with others showing forms of fastening rope, etc. These will doubtless prove useful to builders, quarrymen, farmers, and others who frequently have occasion to use tackles, for hoisting heavy weights and for many other purposes.

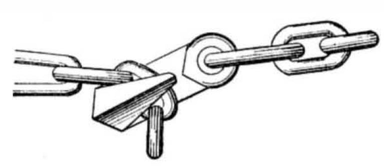
Fig.



Chain-Belt.

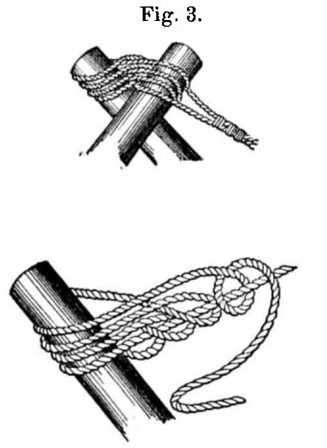
Fig. 1 shows how a chain, by wrapping it with strips of canvas or leather, may be made into a round belt, whereby power may be transmitted. Fig. 2 is a chain hook which simply clamps one link between two adjacent ones. Fig. 3 shows how chains are fastened by ropes, when, as in the case of a vessel's cable, they are to be subjected to heavy strains. The upper figure is termed a double and the lower a single chain fastening. These hitches are very strong and not liable to slip. Fig. 4 is a chain pulley having pockets or depressions in its periphery, in which lie the links or alternate links of a chain which passes over and

Fig. 2.



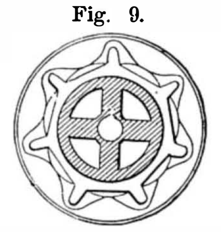
Chain-Hook.

Fig. 3.



Chain-Fastenings.

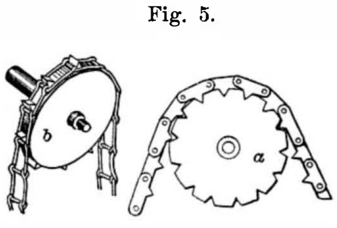
Fig. 9.



Chain-Pulley.

gives motion to or transmits from the pulley. In the chain wheel, Fig. 5, the sprockets of the wheel are adapted to receive the links of the chain successively. The power may be communicated by the wheel to the chain, or conversely. The former is shown in the familiar chain pump, and the latter in machines where the operation is inverted, the column of water pressing upon the buttons attached to the chain and causing them to descend in the tubes, thus rotating the wheels.

Fig. 5.



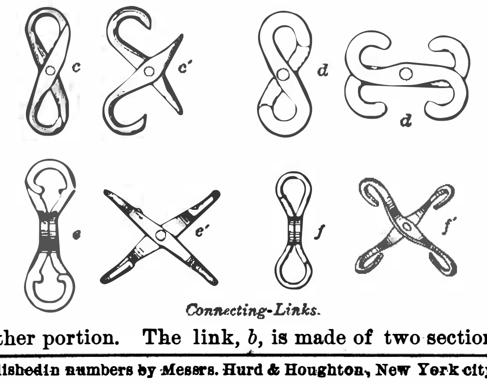
Chain-Wheel.

Fig. 6 represents several forms of

LINKS

capable of being taken apart and thus becoming a means of uniting the broken ends of a chain. Each half of the link, *a*, has a swivel to which it is connected by a head, the swivel of each part forming a nut for the threaded leg of the other portion. The link, *b*, is made of two sections, *b′* *b″*, laid upon each other and riveted. The other figures represent various forms, in which the twin swiveling portions form a mousing for each other.

Fig. 6.



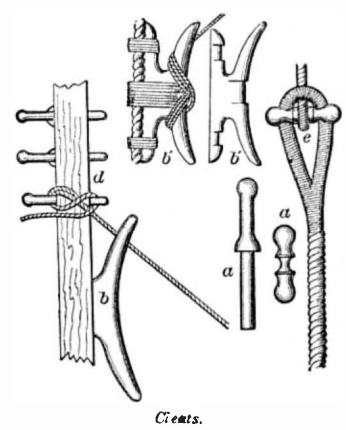
Connecting-Links.

*Publishedin numbers by Messrs. Hurd & Houghton, New York city.

CLEATS.

These are belaying pieces, consisting generally of a bar with two arms fastened to a post or stanchion by a bolt passing through its stem. Those shown at *a*, Fig. 7, are simple belaying pins. *d* is a rope belayed. *b* is a common cleat, lashed in place as shown at *b′*. *e* is a belaying pin or toggle, spliced into the end of a rope to secure an eye upon. Forms of

Fig. 8.

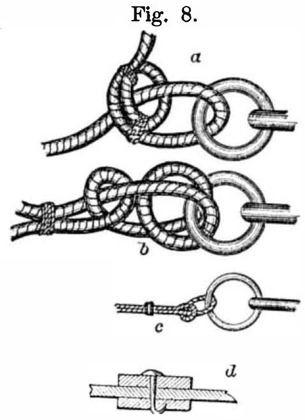


Cleats.

CLINCHES

are shown in Fig. 8. In nautical parlance a clinch is a mode of fastening large ropes to rings, such as anchors, etc. It consists of a half hitch with the end stopped back to its own part by seizings. *a* is a slip clinch; *b* a clinch secured, and *c* a simple clinch. In carpentry a clinch is a fastening, as at *d*, in which the long end of a nail is turned over, and the recurved end caused to enter the material so as to oppose retraction.

Fig. 8.

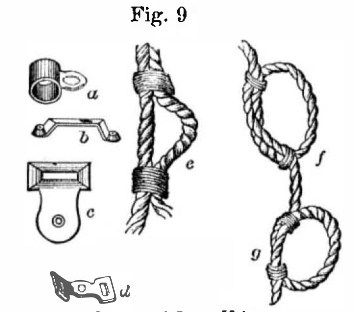


Clinch.

LOOPS

of different kinds are illustrated in Fig. 9. *a* is the simple sleeve or collar; *b*, *c*, and *d* are modifications of the same. *e* is nautically termed a bastard loop. It is stopped in place with rope yarns. *f* is a loop used as a fair leader for ropes, etc *g* is a bend stopped with seizings.

Fig. 9



Loops and Loop-Holders.

Gold in America---Its First Discovery by the Prehistoric Indians.

In a recent speech delivered in the House of Representatives, R. B. Vance, member of Congress from North Carolina, said that the first discovery of gold in the United States was made in Mecklenburg, in that State, in 1820. A correspondent of a North Carolina newspaper corrects this statement, saying that the first gold was found in Cabarrus in 1799, and refers to Wheeler's "History of North Carolina" for evidence.

Old chroniclers give an account of a province called Cofachiqui, which was visited by De Soto's gold-hunting expedition in 1538-40, and which was embraced in what afterward became the States of Florida, Georgia, Alabama, and Mississippi, and, according to Logan, in his history of "Upper Carolina," had its center on the western limits of South Carolina. Its capital and chief town stood upon the tongue of land between the Broad River of Georgia and the Savannah, just opposite the modern district of Abbeville. The Spaniards entered this capital after a two months' march, and found the country ruled by a beautiful Indian queen, Adalla, who entertained the Spanish governor and army with much ceremony. Here they found hatchets formed from an alloy of gold and copper. By this their cupidity was greatly excited, and they concluded that they had found a country abounding in the long coveted precious deposits of gold. And so indeed they had, says Logan (whom we quote freely), but it was neither their good fortune nor their desert to find out the precise spot where gold could be obtained. In less than fifteen miles southeast of the town, on the opposite or Carolina side of the river, lay one of the most extraordinary gold deposits in the world. The Cherokees were well acquainted with the Dorn mine. This is shown by the numerous relics of their handiwork scattered around it, and there can be little doubt that the massive nuggets of its outcropping gold supplied them abundantly with the finer metal of the alloy that so attracted the eyes of the Spaniards. It is no less known, to a few who have inquired into the traditions of the aborigines, that the gold and copper, found in their possession, in the form of solid masses or curious trinkets, by the first white men who visited the country, were obtained from these sources.

The Indian method of smelting these metals was one of the most remarkable devices of savage ingenuity; in practical efficiency the famous blowpipe of Dr. Hare was scarcely superior. Logan tells us that, having first hollowed out flat stone in the form of a basin, they filled it with charcoal, and upon this laid the nuggets of metals. A number of Indians now seated themselves in a circle around the basin, each one having in his hand a long reed pierced through its entire length and armed at one end with a clay tube or pipe. Everything being ready, fire was applied to the charcoal, and the whole mass instantly blown into a powerful heat through the reeds, the clay extremities of which were inserted in the basin, while the Indians blew through them upon the charcoal with all their might, and with protracted expiration. No ordinary lump of either gold or copper could long maintain its solidity in such a crucible. With this process the Indians could easily produce any variety of ornament from those metals, using them either alone or in alloy. This method was known to have been in use among the Indians who lived upon the gold-producing lands of North Carolina, and the same process must have been known to the Cherokees.

These chronicles and traditions go to confirm what Lawson says, that the Indians, from time immemorial, were acquainted with valuable mines of gold and silver in Upper Carolina.—*Columbia (S. C.) Register.*

The American Institute Fair.

The annual exhibition of the American Institute was opened on September 6, at the Institute's building at the corner of Third avenue and 63d street. Very few of the exhibits are ready for public inspection; and there is likely to be, in consequence, a limited number of visitors for the first few days. This want of preparation does great harm to the interests of those exhibitors who make a point of being ready by the opening day, and damages the reputation of the whole exhibition; but we have so often commented on it that it is, we suppose, useless to hope for any improvement.

NEW BOOKS AND PUBLICATIONS.

THE WORLD'S SAGES, INFIDELS, AND THINKERS: being Biographical Sketches of Leading Philosophers, Teachers, Reformers, etc. By D. M. Bennett, Editor of the "Truth Seeker." Price $3. New York city: D. M. Bennett, 141 Eighth street.

Mr. Bennett has attempted, as this title shows, to classify together the wisest and best of mankind and the fool (or infidel) who "says in his heart: There is no God." The work is of necessity a signal failure. It is not by placing the names of Socrates, Bacon, Locke, and Colenso in juxtaposition with those of Bradlaugh, Holyoake, S. P. Andrews, and Susan B. Anthony, that any connection between brains and atheism can be established; and it would be a far worthier (and a easier) task for a writer to point out the sharp definitive line which separates the moderate and tolerant philosopher from the blatherskite who proves his want of belief in a God by his perpetual and venomous hatred of all who differ from his crude and frequently blasphemous opinions. The author evidently hopes that this book will, in some households, take the place of the family Bible; for he has bound up in it some leaves for the registration of births, marriages, and deaths.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED BRUSH-HOLDING RUBBER STOPPLE.

Ferdinand A. Reichardt, New York city.—This is an improved rubber stopple for bottles, which is so constructed as to serve as a holder for brushes, which may thus be kept within the bottle, and may be exchanged as required. The tapering rubber stopple has its inner end perforated with a tapering hole, to receive and hold a brush handle.

IMPROVED DINNER PAIL AND LANTERN.

David T. Platt, Greenwich, Conn.—This invention consists of a dinner pail with a compartment for heating tea and coffee, contrived to serve for a lantern for the workman going home at night

IMPROVED CHEESE CUTTER.

Henry S. Jones, Vincennes, Ind.—This invention is a cheese cutter, by which retailers of cheese and others may cut off pieces that will weigh exactly, or nearly so, the amount required, and at the same time cut them of uniform wedge shape, and from the outside to the center. It consists of a circular horizontal revolving table for holding the cheese, with a graduated scale, showing the sizes for different weights, over which is a radial lever cutter, pivoted to a standard attached to the bed piece on which the table revolves, and being adjustable up and down on the standard, to adjust it to the thickness of the cheese.

IMPROVED TELEGRAPH KEY.

James O. Byrns, Jersey City, N. J.—This is an improved duplex key, by which the time taken up by the upward motion of the present key may be utilized, and the sending of the messages be accomplished in about half the former time, and with greater facility and ease. The invention consists of two horizontal and spring-acted keys, whose contact points alternately close the circuit by contact with an intermediate post, the keys being cut out, when not in use, by the rear set screws bearing against a double post with a dividing insulating layer. The contact of either key closes the circuit, so that by the alternate wording of the keys the working of the hand is utilized in both directions for the transmission of telegraphic characters.

IMPROVED CANNON.

Richard B. H. Leighton, Jersey City, N. J.—This invention is a cannon so constructed as to scatter the shot in a horizontal line. It is provided with a wide, flaring, and shallow bore, and is formed of top and bottom plates, side pieces, and breech piece, riveted to each other. In the inner side of the bottom plate is formed a transverse groove to receive a rib formed upon the lower side of the shell of the cartridge, to keep the cartridge square when putting it in, and also to prevent the cartridge shell from being blown out when the cannon is discharged. Round or square, grape or chain shot may be used, as desired. It is claimed that, with this construction, the wide shallow, flaring bore will scatter the shot in a horizontal line, so that it will do much better execution than when a bore of the usual form is used.

IMPROVED COMBINED BUCKLE AND SNAP.

Richard St. L. B. Chinnery, Kankakee, Ill.—This improved buckle and snap is for connecting the reins to the bit rings, and in so formed that it may be colored to represent leather. It consists is the long bent metal strap, the short straight metal strap, the spring, and the buckle, constructed and combined with each other.

IMPROVED ICE CREAM FREEZER.

Charles L. Dexter, Philadelphia, Pa.—This improved machine for making ice cream is so constructed as to operate upon the cream, while freezing, in about the same way as when it is made by hand. This is effected by the combination with an ice cream freezer, of an outer tub having arms, friction rollers, and angle irons, with the inner revolving can and the necessary operating gearing.

IMPROVED CIGAR BOX.

Thomas A. Dodd, Providence, R. I.—The object is to furnish an improved cigar box, which shall be so constructed as to allow the ends of all the cigars in it to be seen, as well as the top layer. The invention consists in a cigar box provided with a glass front, and having a flap hinged to the forward edge of its top, to shut down over said glass front to prevent breakage.

IMPROVED WEIGHING SCALES.

Alonzo Pangburn, Fremont, Ohio.—This consists of one or more beams, in combination with the ordinary beam, connected by suspending the short arm of the additional beam to the long arm of the preceding one, under which it is located, in such manner that the range of the scale can be increased to any extent required. It also consists of a secondary beam to the principal beam for weighing small articles.

IMPROVED COMBINED BUCKLE AND SNAP HOOK.

Francis J. Deisz, Pierce City, Mo.—This is an improved buckle and snap hook, for connecting a breaststrap with the hames in such a way as to be easily attached and detached, and which will hold the straps securely. Any strain upon the strap causes a wedge block to clamp it more tightly and hold it more securely, a tongue preventing the strap from slipping before the wedge block has clamped it firmly.

IMPROVED REVOLVING BILL HOLDER.

Sylvester W. Maynard, Kingston, N. Y.—This furnishes a neat and compact device for filing bills, receipts, and other papers, in such a manner that they are instantly and conveniently within reach. It consists of a number of receptacles, with spring-acted covers arranged around a central section or case, and revolved or locked by a sliding and spring-acted shaft and fastening device.

IMPROVED HAME.

August H. W. Michaelis, Monroe, Mich.—This invention consists in breast strap rings attached to the hame tug clips, and in the fastenings provided with the guards and the pins and the loops, in combination with the perforated upper part of the hames, for connecting the hame strap adjustably with said hames.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED BRICK MACHINE.

Richard A. Drawdy, Jacksonville, Fla.—This invention consists in two parallel rollers geared to each other, revolving toward each other, placed in an opening in the bottom of the mud box of a brick machine, and driven from the shaft of said mud box by suitable connecting gearing, and also in the combination of the platform and its rollers with the frame, the mud box, and the rollers of a brick machine, so constructed as to force out the clay into the molds with a continuous pressure, so that there can be no imperfectly filled molds, as there will be when the bricks are molded with an intermediate pressure.

IMPROVED ORE-STAMPING MACHINE.

John Patterson, Belfast, Ireland.—In stamping of minerals and metals there is much difficulty experienced, owing to the substances under operation, when finely divided, getting into the bushes or guides of the stampers, and not only causing much increased friction, but wearing away the said bushes or guides and stamp rods; and in stamping of animal and vegetable substances and textile fabrics and fibers, great inconvenience is experienced from the dropping of the lubricating material on to the substances to be stamped. In order to overcome the above injurious effects, the inventor employs vibrating levers to transmit the motion of the crank shaft, through springs and flexible connections, to the stampers.

IMPROVED DOOR LOCK.

Moses C. Hawkins, Edinborough, Pa.—This lock may be used as a fixed tumbler lock or as a combination lock, in combination with keys having fixed or interchangeable bits. It thus may not be easily picked or tampered with. There is a sliding bolt, with interchangeable tumblers pivoted thereto, and so connected to the casing by a detachable screw that bolt and tumblers may be taken out from the casing for changing the combination. The invention consists, further, in the combination of the sliding and notched bolt and the notched tumbler, pivoted thereto, with a swinging fence plate and rigid fence bar, that enters all the notches when set by a combination or reversible key. The reversible key may be finally locked to the inside of the lock by a revolving escutcheon.

IMPROVED PISTON FOR SYRINGES, AIR PUMPS, ETC.

Reinhold Vander Emde, New York city, assignor to himself and Charles E. Koechling, same place.—This invention consists of a piston rod provided with shoulders and elastic collars, that hold intermediate leather washers placed over the same. The washers and collars are readily replaced when worn out by long use, but keep up their working capacity for a long time by the action of the rubber, without getting loose.

IMPROVED WINDMILL.

Daniel Nysewander, Springfield, Ohio, assignor to himself and David Nysewander, same place.—This invention consists in making the vanes of windmills from sheet metal, of such form that it is possible to attach the points, which are bent over toward the center, to a central plate which is fixed on the end of the shaft. Weights are provided at the extremity of the arms, for balancing the wheel and giving it additional momentum when in motion. There is also a convenient device for changing the relative position of the guiding vane, making it possible to control the motion of the mill by this means.

IMPROVED WATER WHEEL.

Leonard Long, Princeton, Wis.—This consists, mainly, of buckets arranged between an interior cone hub and an exterior cone cylinder, the buckets extending from an outer top flange of the inner cone on an inclined segment of a circle to the cone cylinder, and then on an inward and downward spiral curve to the bottom of the same and the lower part of the cone hub.

IMPROVED WATER WHEEL.

Burrell C. Lambeth, Thomasville, N. C., assignor to himself and I. L. Younc, same place.—This consists of a novel contrivance of the alternate gates to form chutes, and the device for opening and closing them is contrived to reverse, for application to wheels running either way. The buckets are provided with spring valves, to regulate the opening according to the volume admitted, so that the water will be applied to the wheel in an effective manner, whether the whole or part gate is used. The wheel is constructed so that it can be reversed to run either way by shifting the attaching disk from one side to the other. The socket of the step has a flat bottom, and the pivot on which it turns has a corresponding flat top. The bearing for the shaft above the wheel consists of boxes let into slots in the tube of the case, the boxes being tapered from bottom up, and being clamped against the shaft by a ring of corresponding form. The case is also reversible by taking off the top and attaching it to the other side.

IMPROVED CUT-OFF FOR STEAM ENGINES.

Julius C. Debes, Jackson, Mich.—This relates to that class of cut-off in which the stroke of the cut-off valves is controlled by the governor; and it consists of a plate placed on a central stud in the steam chest, and provided with oblique slots, which engage with studs on the back of the cut-off valves, varying the time of the admission of steam according to the position of the plate which is varied by the governor.

IMPROVED CAR COUPLING.

David P. Cubberley, Marion, Ind.—The improvements consist in making the latch in the form of a bar of a comparatively small transverse dimension and inclining its rear end (against which the link bears) upwardly, and to the front, so as to cause the link to rise when the draft is exerted and occupy a position more in alignment with the greatest strength of the latch bar, whereby a much lighter latch may be employed, and the manipulation in disengaging the link rendered easier, and whereby also the draft strain is made to assist in holding the latch down.

IMPROVED CAR COUPLING.

James H. Wood, Baltimore, Md.—This invention consists in providing a drawhead with an armed shaft that couples and uncouples with the hook bar, a presser board hinged to the front of the drawhead and forming the cover thereof, and a crank that lifts the presser bar at the same time that it raises the coupling bar. These features of improvement render automatic couplings, heretofore regarded as impracticable, easily manageable and little liable to get out of order.

IMPROVED BELT SHIFTER.

Augustine Crosby, Benton, Me.—This invention is an apparatus for shifting belts for stopping or starting machinery; and it consists of a roller supported in a frame that is placed parallel with and near the tight and loose pulleys on the counter shaft, and is pivoted so that the roller may be made to bear against either side of the belt according to the direction in which the belt is to be shifted. It further consists of an arrangement of a rack and toothed sector, by means of which the roller is moved. The advantages claimed for the invention are that with it belts can be shifted without being subjected to wear, that it is particularly adapted to rubber belts, as it does not chafe them, and that it shifts the belt smoothly, without jarring or noise.

IMPROVED IMITATION STITCH MACHINE.

Edwin Brown, Georgetown, Mass.—The object of this invention is to make what is known as the "imitation fair-stitch" on boots and shoes, that is, indentations on the upper margins of the soles, having the appearance of the stitches by which the soles are sewed on in hand work. It consists of a milled indenting roller on the end of a crank shaft, under which is a carrying roller, made to slide up toward the milled roller by a lever which is to be worked by foot power, to carry the sole and press it against the milled roller, which, being turned by the crank, makes the indentations or imitation stitches, at the same time feeding the work along. The milled roller and its shaft-carrying roller and the lever are all attached to a plate, which may be readily attached to a bench or other suitable support, making, it is claimed, a simple and cheap machine.

IMPROVED AUTOMATIC FERRY BOAT COUPLING.

Thomas D. and George E. Husband, Green Point, N. Y.—This is an improved device for connecting a ferry boat to its bridge, so constructed that it will couple itself as the boat comes into its place, hold the boat securely, and may be easily uncoupled to release the boat when desired. The invention consists in the combination of the sockets, the hooks, the springs, and the levers, with each other, and with a ferry boat and bridge, and in the combination of the wheels, the recesses, and the guide bars, with the ferry boat and bridge for guiding the hooks into the sockets to interlock with the other hooks.

IMPROVED PEG FLOAT.

James Popham and Ebenezer Popham, Montreal, P. Q.—This is a machine for breaking or cutting the projecting ends of pegs from the insoles of boots and shoes; and consists of a grooved cutter, of pyramidal or cylindrical shape, attached to the end of a rapidly revolving shaft, in connection with a protecting guard or casing. The cutter serves to cut off the pegs of long boots, and is for this purpose made cylindrical, with groover and cutting blades at the circumference, for cleaning the peg ends from the sides instead of downwards, and with the pyramidal cutter. One and the same machine may thus be applied, without any special adjustment, to every variety of pegged work, from children's wear to the largest and strongest goods in men's sizes.

IMPROVED DEVICE FOR PUNCHING MACHINES.

Louis Prahar, New York city.—This invention is so constructed as to feed the material forward to the cutting tool as it is required. This is effected by the movement of a pendulum operating feed rollers to carry the material forward to the cutting tool, the rapidity of the feed being regulated by the size of gear wheels.

IMPROVED SHAPING ATTACHMENT FOR ENGINE LATHES.

William Brede, Lihne, Island of Kanai, Hawaiian Islands.—This invention is an improved shaping attachment for lathes, so constructed as to do all the work required by an iron or brass worker, while saving the space that would be occupied by a shaping machine, and at the same time being much less expensive. It consists in the combination of the slotted plate, the arm provided with a dovetail tongue, the blocks, tool holder, and swiveled screw, and the connecting bar, with each other, to adapt them to be applied to the face plate, spindle, and frame of a lathe; in the table provided with the lug, the bent arm, and the adjustable cross bar, to adapt it to be applied to the lathe bed, the carriage, and the frame of a lathe; and in the combination of the cam wheel, the bent lever, the connecting bar, the slotted bar provided with the collar, and the pawl, to adapt them for attachment to the friction wheel and the feed screw of a lathe. For heavy work, the attachment may be strengthened by a brace bar, the forward end of which is bolted to the forward end of the arm, and its rear end is bolted to the bracket or bearing of the lathe.

COMPOSITION FOR LINING PUDDLING FURNACES, ETC.

Marie Eugène Paul Audouin, Paris, France.—This invention is a composition or substance calculated to more effectually resist the action of oxide of iron than any other material heretofore employed for the purpose. This material is oxide of chromium, which is capable of resisting the very highest temperatures employed in furnaces and laboratories—such as the Siemens furnace and furnaces heated by dead oils—and is also proof against the action of oxide of iron at the highest degrees of heat. The inventor claims that there is no danger of the oxide being reduced under the ordinary conditions of working, and, moreover, the presence of a small quantity of chromium will not affect the quality of the iron. This oxide may also be utilized in the manufacture of fireproof blocks to be exposed to the action of furnace cinder and scoria, but with less advantage, as, by the action of certain principles, more especially potash, soda, and lime, chromates are eventually found.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED BENCH PLANE.

Jackson Gorham, Crawfordville, Ga., assignor to himself and Charles E. Smith, of same place.—This invention consists of a stud applied on the top of a smoothing plane stock near the heel, and adapted to fit between the thumb and forefinger of the right hand, while the palm bears against the heel of the stock, whereby the pressure of the hand is distributed over a larger surface, and is thus diminished on the small area heretofore employed for driving the plane by pressing against the heel of the stock. It also affords a bearing or rest for a part of the hand not heretofore having any support on the stock, and therefore making the work easier.

IMPROVED LATH MACHINE.

Edmund H. Hancock, Augusta, Ga.—The invention consists in placing edge-serrated planes in advance of a saw, to cut grooves, in attaching the upper grooving plane to a pivoted shoe provided with a handle, and in combining collared rolls with spiral feed rolls having a right-angled groove next to the collars. The sides of the grooves of the rollers, next to the guide collars, are cut at right angles to the axis of the collars, the taper being all on the other sides, whereby they draw towards the collars better than if beveled alike on both sides. Guard fingers prevent the saws from throwing sticks back against the attendant, which is a common occurrence in gang saw machines, particularly when the saws are out of order: these fingers are pivoted to the frame over the way where the stuff passes, and rest on the stuff in such manner that the friction of a piece of lath or other object pushing back under them causes them to bind it fast and thus stop it.

IMPROVED BRAKE FOR LIGHT VEHICLES.

Charles H. Appel and Joseph S. Rothenberger, Shimerville, Pa.—This improved brake has all of its parts connected with the shafts and front axle, so that the springs are subjected to no strain when the brake is operated, and the arrangement of the parts such that they are out of the way and not liable to be bent or broken from contact with any object. In applying the brakes there is no strain upon the springs, as there must necessarily be when the brake is attached to or connected with the body of the vehicle.

IMPROVED SAW SET.

Christopher Heinen, Fort Laramie, Wyoming Ter.—In this saw set a number of teeth may be set in opposite direction at one operation of the device, and the same be adapted to set any kind of saw by inserting the dies fitted to the saw. The invention consists of a lower base part and a swinging lever part, with removable dies, gage piece, and regulating screw. The saw is set into the dies from right to left, and the lever then brought down to set the teeth. The person operating the set stands in front of the same, adjusts the saw, and brings the lever down without changing his position, setting the teeth thereby directly at one operation, in opposite direction, without reversing the saw or saw set.

IMPROVED ELEVATOR.

John G. Kurtz, Milton, Pa.—This is an improved elevator for use by carpenters, masons, and painters, for raising their materials and themselves upon buildings, in stores, hotels, and other buildings, and by firemen and others; and it consists in a standard made in sections, and provided with a T groove, the jointed rack bar, and the gear wheel, in combination with each other and the frame, and a mechanism for turning the said gear wheel; in the combination of the springs, the pins, and the cam levers, whether the second set of springs be used or not, with the hinged ends of the sections of the standards; in the combination of the bar, the arm, and a platform, gallery, or cage with grooved standard, and with the jointed rack bar and the gear wheel: and in the combination of the spool and the coiled spring with the jointed rack bar.

IMPROVED DUST GUARD FOR CARS.

William Carr, New York city.—The inventor's object is to furnish for the traveling public a portable dust guard for railroad cars, which may be readily attached to the window of a car so as to prevent the annoyance by cinders, while it also may be used as a fan and readily folded up after use, for being carried in the pocket. The invention consists of a guard made of a number of folding pieces or strips, that are rigidly connected by a clamp piece, pivoted to one strip and fitting over the ends, which folds with the strips when released. When the dust guard is detached, it may be used as a fan, and finally be folded into narrow compass, for being carried in the pocket, by releasing the clamp piece from the ends and folding it alongside of the strips. The strips may also be made available for advertisements, so that the dust guard may be used as a convenient advertising medium for the traveling public.

IMPROVED PRIVY SEAT.

Peter D. Howard and Matt. Allard, La Porte, Iowa.—Should a person attempt to stand upon this seat, to use the privy, the seat will tilt, and thus the seat will always be kept clean.

IMPROVED WAGON BRAKE.

Frank Funk, Beverly, Ill.—This invention consists of a lever connected with a fulcrum bar and brake rod, all so arranged that the power is gradually increased, as the brake is pulled by the brake rod connected with it against the wheel. The propelling lever is provided with a longitudinal projection or detent to lock the brake by engaging with a rack bar attached to the side of the wagon.

IMPROVED CHIMNEY COWL.

Jacob M. Davies, Enon Valley, Pa.—This invention consists of a pipe elbow, fitted to turn on a spindle on the top of the chimney, constructed with that portion through which the smoke escapes in a form calculated to be equally as efficient as the hood or funnel commonly used to facilitate the discharge of the smoke, and to be less liable to catch the wind, when contrary and shifting gusts prevail, and conduct it down the chimney into the room, which is so common with the ordinary cowls.

NEW AGRICULTURAL INVENTIONS.

IMPROVED ANIMAL TRAP.

Jacob W. Wilson, Summerford, Ohio.—This trap is so constructed as to close when the animal enters the first compartment, to prevent his escape, and set itself when the animal enters the second compartment or cage. The invention is formed by the combination of the swinging gates, the cranks, the connecting rods, the weighted platforms, and the bent arm with the box of the trap and with the gate hung in the opening through the partition of said box.

IMPROVED POTATO DIGGER.

Edward Bartlett, Renfrew, Ontario, Canada.—This invention consists of arrangements of colters for cutting along the sides of the row of potatoes, a scoop for digging them up, a revolving spout or reservoir for separating them from the earth, beaters for preventing the clogging of vines and wood on the scoop, a contrivance of the separators for discharging the potatoes into a spout, apparatus for separating and discharging the vines and weeds, and a discharging apparatus for removing the filled boxes which receive the potatoes from the spout, also supporting, operating and adjusting devices.

IMPROVED WEANING BIT FOR ANIMALS.

George W. Ingersoll and Harvey L. Fisher, Toledo, Iowa, assignors to Jacob L. Neff and Henry Giebert, of same place.—This is an improved weaning or anti-suction bit for calves, by which the animal is prevented from sucking, and no incumbrance caused to the same in eating and drinking. The invention consists of an outer hollow tube with air holes at the central part, and open ends with an interior revolving tube with central air holes and open weighted ends. The air holes are not liable to get clogged, so as to exclude the air and supply the air at every attempt at sucking, thereby preventing it and weaning the animal. When the animal holds its head in a downward position for eating and drinking, the inner tube is turned by the weights, and the air supply interrupted as the connection of holes of the inner and outer tubes is discontinued. This automatic interruption of the air supply of the bit forms the main feature of the invention, as thereby not the slightest inconvenience to the animal in drinking is produced, and the same is not compelled to put its whole nose into the water to exclude the air, which forms a serious objection to the bits at present in use. The friction of the inner and outer tubes prevents the clogging of the air holes, and secures, in connection with the weighted tube, the reliable working of the bit, namely the opening of the air supply holes to prevent sucking, and the closing of the same during eating and drinking.

IMPROVED HARROW.

Jackson De Moss, Noblesville, Ind.—This invention is a harrow or pulverizer, which is claimed to thoroughly pulverize the ground and adjust itself to an irregular surface, so that it will level down a ridge or fill up a dead furrow with equal effectiveness, which may be easily cleared of rubbish, raised to pass an obstruction, and may be easily loaded upon and unloaded from a vehicle for transporting it from place to place. By removing the teeth from the central beam the harrow may be used for cultivating small corn, or other small plants planted in rows, loosening the soil upon both sides of the row at the same time; and by removing a pin from a hook, the harrow will come apart, and may be easily loaded upon a vehicle.

IMPROVED WAGON COVER.

Charles Cremer, Red Bluff, Cal.—This is an improved cover for the boxes of wagons, cars, and other vehicles for transporting swine, calves, sheep, fowls, etc., constructed so as to allow the air to have free passage to the animals, while confining them securely. The invention consists in the combination of the net, the four rods, the connecting snap hooks and rings, and the holding snap hooks, with the body or box of a wagon, car, or other vehicle. By this construction the animals are securely confined, and at the same time have the benefit of a free circulation of air. The rear end board of the box may be removed to allow some of the animals to be taken out or others put in, while guarding against the escape of any.

IMPROVED SULKY PLOW.

Alexander Hamilton, Harrisburg, Ark.—This sulky plow is constructed that the plows may be readily raised from the ground, drawn back from an obstruction, and adjusted to work any desired depth in the ground.

IMPROVED PLOW STOCK.

James A. Price, Houston, Tex.—This improved plow stock is so constructed that any kind of a plow and standard may be applied to it, according to the kind of plowing to be done. Each plow is designed to be attached to its own standard.

IMPROVED GATE.

Uriah W. Hardy, Albion, Ill.—This is an improved farm gate that may be readily opened and closed by a person on horseback, and from the seat of a vehicle. Fulcrumed levers that extend alongside of the road operate, by rods, bars, cords, or chains, a folding or weighting gate. A separately pivoted latch piece at the upper part of the gate locks into the recessed post when the gate is lowered.

IMPROVED MILK COOLER.

Thomas Sexsmith, Oneonta, N. Y.—This consists of an elevated cooling compartment in the bottom of the pan which holds the milk, into which the cooling medium is delivered by an inlet pipe, so arranged that the said medium is discharged directly upward from the mouth of the pipe against the shell of the compartment. The discharge passage leads out from the bottom of said compartment, to which the warmer part is forced by the incoming part being discharged between it and the shell of the compartment. The invention also consists of a contrivance for mounting the pans on their supporting stools, so that they can be readily leveled up in case the stools are not level.

IMPROVED GRAIN SEPARATOR.

Thomas C. Jory and John W. Jory, Salem, Oregon.—This separator is designed especially for cleaning wheat, but will, by proper adjustment, separate oats from wild oats. It involves in construction the following four principal features: First, a regulating and distributing feeder, by which the same amount of grain flows from the hopper at each turn of the crank, and is evenly distributed over the entire surface of the cleaning apparatus; second, an arrangement by which cockle and other small seeds are separated from wheat, the same being a revolving cylindrical screen, through which, as it revolves, the grain is conveyed by a spiral flange closely fitted to its inner surface throughout its entire length, and a plain hollow cylinder of sheet iron, surrounding the screen and concentric with it, and having a flange working in the opposite direction to receive and discharge the seeds, small grain, etc., at the opposite end. Thus the wheat flows from one end of the revolving cylinder, and the small seeds from the other, and both may be collected in proper receptacles. Third, an arrangement for keeping the screening apparatus clean by a vertical shake communicated to it (as is also its rotary motion) by cam wheels revolving under each end of the screen. Fourth, the carrier is kept free from wild oats, etc., by means of stirrup-shaped knocker, which strikes a quick, light stroke on the under surface of the carrier at each descent of the screen, from which it takes its motion.

NEW HOUSEHOLD INVENTIONS.

IMPROVED FOLDING CHAIR.

Adile Matthiessen, Cornwall on the Hudson, N. Y.—This chair has a back piece, to which are hinged the seat and arms. The front legs are hinged to the seat, and a brace is pivoted to the back legs in such a way as to be capable of holding the various parts in their places. The principal object of th invention is to furnish a convenient nursery chair, which can be folded and placed in a trunk.

IMPROVED DESK.

Charles A. Atkinson, New York city.—This consists in a desk made in sections, so constructed that they may be connected and disconnected at will; and in the combination with the main desk, of one or more side sections or wings, so constructed and hinged that they may be closed against the sides of the said main desk, moved forward to expose their contents, and swung back out of the way while still exposing their contents.

IMPROVED COMBINED DISH AND CLOTHES WASHER.

Asberry C. Jackson, Orange, Texas.—This is a detachable clothes washing attachment for a sink, and a tilting shelf, upon which dishes may be placed for draining off the water into the sink. The wash pan and the draining shelf are surrounded on the sides and top by a cabinet case, which is located in this relation thereto for convenience in storing away the dishes.

IMPROVED FOLDING CHAIR.

Frank F. Parker, Gardner, Mass.—This consists of a folding chair made of a back section, that is pivoted by its recessed ends to fixed projecting pins of the swinging rear leg section, while the front leg section is extended above the seat pivoted to the back, and hinged by a lateral cross piece to staples of the rear leg.

IMPROVED APPARATUS FOR AUTOMATICALLY LIGHTING AND EXTINGUISHING GAS.

Asahel P. Bell, Manchester, and Thomas Thorp, Whitefield, England.—In this invention, a metal cap is secured to the gas main, and wool or other fibrous material acts as a filter for the gas. A receptacle, made of earthenware or other suitable material, contains mercury. The gas from the main passes into the receptacle through vertical holes, all of which may be left open, or some may be closed according to the differences of pressure in the gas main. A center piece, in a recess in the receptacle, contains a chamber for mercury, and this chamber has an orifice, above which is a hollow cylinder, and a second orifice, in which the burner for the flaring jet is fixed. At the lower side is a pipe mouth valve, through which the gas passes into a tube provided with an ordinary burner. A hollow cylinder is fixed to a metal shell suspended to the burner by wire, and a loop of platinum wire, connected thereto, is carried over the burner. When the gas is at its maximum pressure, it depresses the mercury in the center compartment of the receptacle, thereby uncovering a valve and allowing the gas to enter the tube. A small portion of it passes through an aperture to a small interior burner, and this portion of gas is then ignited by the jet and a second platinum wire. The flaring jet from the small principal burner then ignites the gas issuing from the burner. When the cylinder is heated by the wire passing through the flame, the inclosed air expands and expels the mercury, which falls into the chamber and closes the aperture and shuts off the gas.

IMPROVED EXTENSION BEDSTEAD.

Rudolf Rigl, Dobling, Austria, assignor to Franz Xaver Katzmayr, Vienna, Austria.—This invention is an iron sofa bed, for hotels, boarding houses, etc., that may be readily changed from a sofa to a single bed, or to two connected beds, or to two entirely detached beds, as desired, the whole forming a strong, compact, and convenient sofa bed for various purposes. When the sofa covering is taken off, a telescoping section may be used as a single bed. When it is desired to make two separate beds, the sliding action is taken out of the frame, and a foot support clamped or otherwise attached to the end section that has been taken out of the main frame. The sliding section forms thereby a searate bed, which may be put up in a different room from the main frame, to be replaced at any time by detaching the end support and sliding the bed section back into the main frame, storing the whole in convenient manner below the covering, and allowing the use of the bed as a sofa.

IMPROVED COMBINED STOVE PIPE THIMBLE AND REGISTER.

Charles Pettit, Erieville, N. Y., assignor to himself and Levi P. Greenwood.—This invention consists of a large tube extending through the ceiling and floor, and having a top and bottom plate, through the center of which the pipe passes in a center tube, which is surrounded by a larger tube and a dead air space, or a lining of non-combustible material, to confine the heat, so as to prevent the heating of the floor through the outer tube. The top and bottom plates are provided with openings to allow the air to pass for ventilating and for heating, and one is provided with a register.

IMPROVED SEWER GAS TRAP.

John M. Falk, New York city.—This invention consists of a trap, similar in form to the ordinary trap, or of any other approved form, except that it is preferably larger, and located near the sewer, from the upper end of which is an escape pipe for the gas that may work through the trap, and with or without another trap above the escape pipe to check the gas escaping through the first trap and cause it to escape through the pipe provided for it, which pipe may discharge in any convenient place, such as the gutter or the chimney of the house.

IMPROVED SUMMER STOVE.

Charles H. Chase, Newport, R. I.—In this invention, a fire pot, of any suitable form or construction, large enough to cover the pot hole of an ordinary stove, is made flat on the top, and has an opening therein, in which a cooking pot may be set, and which may be closed by the cover removed from the pot hole of the ordinary stove on which the stove is set. The smoke passes through a damper into a diving flue to escape into the large stove, so that the flue of the latter serves for the flue of the summer stove. An oven may be used in connection with this stove for baking. It is detachably set on the top of the stove, and has a flue passing around it from the opening through its bottom, where the smoke enters, to another opening, where it escapes into the diving flue and passes off as when the oven is not used, the damper being closed when the oven is used.

IMPROVED STEAM WASHER.

Cyrus C. Carter, Neeleyville, Ill.—This invention is claimed to be so constructed as to enable the clothes to be washed evenly and thoroughly, with much less fuel and in much less time than when they are washed in the ordinary way. It consists in an improved steam washer, formed of the flat base or bottom, the inclined sides, the V-shaped concave top, the rounded and inclined ends, and the vertical plates, and provided with the holes to adapt it for use. In using the steamer, water is put into it and heated. The steamer is then placed in the boiler, the clothes are put around and over it, and in a few minutes the clothes will be thoroughly and evenly cleaned, and may be wrung out to dry, the peculiar form of the steamer causing the steam to pass through all parts of the said clothes.

IMPROVED WASHING MACHINE.

John Zeller, Stouchsburg, Pa.—This machine is so constructed as to rub the clothes in a manner analogous to hand rubbing, will enable soiled parts to be rubbed longer than the cleaner parts, and will not injure the clothes.

IMPROVED FRUIT AND JELLY MASHER AND STRAINER.

Adolph Conrady, Cincinnati, Ohio.—This consists in a metal cup with perforated sides, in which is a press follower, with a screw for working it. The screw is mounted in a crosstree, detachably connected to the top of the cup, so as to be readily attached and detached, to facilitate the application and removal of the follower for filling and clearing out the cup.

IMPROVED COOKING STOVE.

John C. McClamroch, Edina, Mo.—This relates to an ash box located below the perforated bottom of the ash pit, and provided with a register in its side to admit air, so that the ash box may be utilized as a fire box.

Business and Personal.

Notes & Queries

O. J. H.'s letter has been placed in the hands of a prominent physician for reply.—C. W. J. should obtain the best medical advice.—W. R. will find a recipe for a black walnut stain on p. 90, vol. 32.—W. N. will find directions for making concrete gravel walks on p. 50, vol. 32.

(1) J. L. C. says: I have a surveying compass, the needle of which does not traverse well. What is the cause, and how can I remedy it? A. It has probably become demagnetized. You should have it charged again.

(2) G. W. D. says: Referring to your recent descriptions of reflectors and to the article in your paper of November 28, 1874, entitled "A Possible Improvement in House Heating," I beg to inquire if any considerable increase of heat could be obtained by massing, by means of reflectors or lenses, the radiations from furnaces, gas, and oil lamps, or other artificial sources, provided the beams are carried in parallel rays and arrested within, say, 6 feet of the focus. I apprehend no difficulty in so utilizing the sun's rays, but am doubtful as to the gain of heat, in massing heat radiations from other sources. I would not require over 200° Fah. Can this be accomplished, and how? A. All heat rays are susceptible of accumulation by concentrated radiation, whether of the sun or of artificial combustion. Blackened surfaces constitute the heat radiators. Place a wire basket filled with a small shovel full of glowing coals in the focus of a reflector, and the heat rays from it will ignite phosphorus in the focus of a supplementary reflector 12 feet distant. A number of reflectors, so placed behind as many fires as to concentrate the heat rays upon a given point, will cause a degree of heat at that point corresponding in intensity with the combined rays of the fires, less the loss by absorption into the medium through which they pass. Light rays from the moon may be concentrated as readily as those from the sun, but no degree of multiplication of such rays will reveal any appreciable accumulation of heat. From this it is to be inferred of this reflected heat that what little of heat from the sun there may be, that is not absorbed by the moon, is lost on its way to us in its passage through the atmosphere of the earth.

In using compressed air, would there be any gain of power (without reference to the question of economy) by devaporizing and heating before compressing the air? A. If you heat the air at constant volume, before compressing it, the pressure will be increased; and then if it is compressed, the pressure will of course be greater than if it had not been previously heated.

(3) R. K. asks: What is the best material for locomotive boiler tubes for conducting heat, copper, brass, or iron? A. Brass.

(4) W. H. H. W. says: My neighbor has a well 40 feet deep and 800 feet from his house. The house is 10 feet lower than the bottom of well. Will it be possible to draw the water from the well by a siphon? Is it necessary to lower or cut away the hill that the water will not be required to rise more than 30 feet. What size of pipe should be used? A. It will not be advisable to attempt to raise the water more than 25 or 26 feet, nor to use a pipe smaller than 1 inch in diameter.

(5) A. F. B. asks: Is it a saving of battery material for a Callaud gravity battery to stand open at night? A. Yes.

(6) J. T. B. asks: 1. Will electricity, passing through a magnet, change its poles? A. Yes. 2. Which is the cheapest way to run a strong electric battery? A. A carbon battery excited by bichromate of potash is the cheapest where great power is required.

(7) G. W. McD. asks: Does the air in the air chamber of an hydraulic ram change in the operation of the ram, that is, does more enter and some escape, in the working of the ram? A. Yes.

(8) C. C. J. R. asks. 1. If the circumference of a steel wheel be placed near a large magnet, does the wheel become a magnet? A. Yes. 2. Where are its poles situated? A. One pole would be next to the permanent magnet, the other would probably be on the opposite end of the wheel. 3. Does the horseshoe magnet of a magneto-electric machine lose its power by use? If so, is the loss much? A. Yes, gradually; but the loss is sometimes almost insensible for a long while. 4. Does it continue to lose as long as it is used? A. Yes. 5. How many revolutions ought a magneto-electric machine to make in a minute to produce the strongest current of electricity? A. The current will increase with most machines until the velocity of the movable magnets exceeds 1,000 revolutions. 6. Does a magnet lose its power when placed near the circumference of an iron or steel wheel which is revolving? A. Yes.

(9) W. N. M. says: I have the two conductors of an electrical machine. and the plate, shaft, and crank. There are no rubbers, and I want to know of what material to make them, and whether to put them between the wheel standards or on the same standard as the brass globe. A. Make the rubbers of leather and stuff them with horsehair. They should be attached to the standard carrying the brass globe.

(10) C. H. R. says: I notice in your accounts of the working of some of the many cables that electricians have experienced much difficulty in attaining a speed in the transmission of signals that was sufficient to relieve the pressure of business, and, in order to hasten it, have formed a metallic circuit by joining two wires, thereby overcoming in a measure the effects of the secondary current produced in the cable by the primary. I have often noticed in some of my experiments the strong natural tendency of the electricities when separated to reunite, and would suggest to electricians, if they think it worthy, a trial (my facilities in regard to the necessary apparatus being too limited for any conclusive experiments). If a vessel could be so constructed as to hold negative electricity (which could be accomplished by charging it, and drawing the positive to the ground), by attaching it to one end of the cable, and by working the opposite end with positive electricity, it might possibly not only hasten signaling, but overcome some of the other difficulties and make one cable free to work in opposite direction. A. The idea is impracticable for the reason that a signaler cannot operate opposite ends of the cable at the same instant.

(11) T. E. asks: What size of boiler should I use for a small engine, with 1 inch bore and 2 inches stroke? A. Make one 9 inches in diameter and 15 inches high.

(12) J. P. asks: How would you determine in horse power the best way steam heating should be charged? A. This must be a matter of argument, as there is no universal standard. A very common rating would be to charge the number of cubic feet of water evaporated per hour for heating purposes, as so much horse power. Others would multiply this by 2, to get the horse power.

(13) L. W. says: I am told that telegraph messages, in traveling from one station to another, go through the ground, and that the wire serves to complete the circuit. Our operator says that the current passes over the wires, and that the ground wire serves to complete the circuit. A. The signals pass over the wire only. The earth merely completes the circuit by acting as a reservoir for the electricity discharged at each end of the wire.

(14) J. W. S. asks: 1. Is the actual pulling power of a locomotive engine with 4 feet driving wheels greater than with 5½ or 6 feet wheels, weight of locomotive, size of cylinder, and all other things being equal? A. Yes. 2. Why are small driving wheels generally adopted for freight locomotives? A. Because they are required to haul heavy loads, and great speed is not wanted.

(15) J. A. W. says: How much more will a screw 3 inches in diameter lift, than one 1½ inches, of the same pitch or number of threads per inch? A. Disregarding friction, the rule is as follows:

$$\text{Weight raised} : \left\{\begin{matrix}\text{force}\\ \text{applied}\end{matrix}\right\} :: \left\{\begin{matrix}\text{circumference}\\ \text{described by}\\ \text{force}\end{matrix}\right\} : \left\{\begin{matrix}\text{pitch}\\ \text{of}\\ \text{screw.}\end{matrix}\right\}$$

Hence the relation will be the same for all screws having the same pitch.

(16) W. S. W. asks: Is there any difference between an open crank motion or an eccentric motion? An eccentric motion is a solid crank, but the positiveness in the motion seems not to be the same. Are there the same dead points in an eccentric as there are in a crank? A. Yes, the motion is the same.

(17) F. C. W. asks: How many times will a locomotive cylinder fill and exhaust in a second? A. Take the case of a locomotive with 6 feet driving wheels, moving at the rate of 40 miles an hour. The wheels would make a little more than 3 revolutions per second, so that the cylinder would be filled a little over 6 times.

(18) H. W. K. asks: What is the process of tempering solid steel dies in lead? A. By heating steel in melted lead the outside becomes sufficiently hot to harden before the inside does; hence the inside is left comparatively soft, and the steel is therefore not liable to crack in the hardening. Another advantage is that the heating, and hence the tempering, is very uniform.

(19) W. C. A. asks: Will it make any difference in the working of a main telegraph line if I should use it for a return wire for a short circuit, putting keys, sounders, and local battery on the short circuit wire? A. It would not interfere with the working of the main line. Vocal sounds have been sent through a few feet of wire.

(20) J. W. S. says: Does steam at pressures from 40 to 125 lbs. per square inch destroy the elasticity of steel springs working in the boilers? A. Good springs are quite durable in such situations if they are protected against corrosion.

(21) E. W. W. says: I am building a cistern in my cellar with the inlet pipes each 2 inches in diameter, running from the roof, about 20 feet. How large should the outlet pipe be to prevent overflow? A. Make it 3 inches in diameter.

(22) A. R. asks: What is the formula for the number of feet in a telegraph pole? A. The following is given for timber measuring: G=¼ girth at middle in feet. g=¼ girth at one end in feet. g'=¼ girth at other end in feet. L=length of log in feet. c=cube contents of same in feet.

$$c=L\left(\frac{G+g+g'}{3}\right)^2.$$

(23) M. G. says: I have been trying to gold plate a chamber of a revolver. It had been nickel plated, but it had partly peeled off, so I took it all off. I cleaned it thoronghly, and (to plate it with copper first) I plunged it into a solution of sulphate of copper, and it turned all black. I would like to know what is the reason for this. A. Clean the chamber again carefully, and use a cyanide instead of an acid solution of copper for the first thin deposit. The superior chemism of the acid for iron or steel over that of acid for copper is sufficient to produce the results obtained. Do not use too much battery.

(24) W. F. C. says: What is heat lightning? A. Heat lightning is a name given to the reflection of lightning discharges that take place below the horizon or behind clouds.

(25) A. R. W. asks: Can you give me a recipe for a phosphorus paste for cockroaches? A. Take phosphorus 1 oz., warm water 1 pint; put in a bottle, cork up, and agitate till the phosphorus is in a minute state of division, adding towards the end moist sugar ½ lb. Then add lard melted by gentle heat 1 lb., and repeat the agitation till the whole is nearly cold; when cold, form it into a stiff dough with oatmeal, and make into small cakes. Dry in the air.

(26) I. E. H. asks: How can I make rubber stamps? A. Vulcanized rubber is used, as prepared by the manufacturers, and can be procured in strips about 3 inches wide and ⅛ inch thick, and of any length desired. The name and address should be set up in type and well oiled; a rim about ⅛ inch in hight should be placed around the form, and dentist's plaster, mixed to the proper consistence, poured in and allowed to set; then the plaster cast is to be separated from the type. A piece of the vulcanized rubber is then cut out, of the size of the plaster mold, and laid upon it, and both together are placed in a screw press, and heat sufficient to thoroughly harden the rubber is applied. The screw is then turned down hard, and left for a time until the rubber is perfectly forced into the mold. After the whole is cold, the rubber is separated from the model, and any irregularities trimmed off with a sharp knife; the rubber stereotype is then fastened, with glue or other cement, to a block of wood, and the stamp is ready for use. 2. Of what is the well known oil bath for vulcanizing rubber composed? A. At the present day Parkes' method is generally adopted; the caoutchouc is simply immersed in a mixture of 40 parts sulphide of carbon and 1 part chloride of sulphur; it is next placed in a room heated to 70° Fah., and, when all the sulphide of carbon has been volatilized, the process is so far complete that it is only requisite to boil the material in a solution of about 1 lb. caustic potassa in 2 gallons water, the vulcanized caoutchouc being next washed to remove excess of alkali.

(27) H. D. M. F. asks: What is a bogie? A. "A four-wheeled truck supporting the fore part of a locomotive, and turning beneath it to some extent, if necessary."—*Knight's Mechanical Dictionary.*

(28) C. D. K. asks: 1. How can I stain light yellow brick so as to give them a dark color? A. You cannot stain brick a permanent color as you can some kinds of wood. The nearest approach to it probably is the cement wash which permeates the pores of the brick. Something of the nature of a glaze might be fixed into the face of the brick in the kiln. Light brick may be made darker by smoke, but the color will be neither even nor agreeable. Cement or oil paint is the most practicable.

(29) C. M. asks: Would a moist blast for forges, etc., be injurious to the iron? A. No, but there would be no advantage derived from the introduction of moisture.

(30) C. F. G. asks: For what are barytes used? A. The sulphate of baryta is the permanent white of water color artists; it is also employed to adulterate white lead. When mingled in excess with the latter pigment it forms Dutch white: in equal quantity Hamburg, and in lesser amount Venice, white. But it becomes, when ground with oil, translucent, and impairs the opacity of the lead paint.

(31) O. J. H.—Paris green (Schweinfurt green) is an aceto-arsenite of copper. In 100 parts: oxide of copper, 31·29; arsenious acid, 58·65; acetic acid, 10·05. Dr. Ehrmann gives as its formula:

$$\left.\begin{matrix}(C_2H_3O)_2\\ Cu\end{matrix}\right\} O_2+3\,(CuO,As_2O_3).$$

(32) A. M. S. says: You stated some time ago that glycerin was a low form of alcohol. Some students tell me it is an oil. A. The alcohols are classified after the number of the O H, or hydroxyl, groups contained in them. Thus: ordinary alcohol (ethylic alcohol)—C_2H_5 (O H)—is a monatomic alcohol; C_2H_4 $(O\ H)_2$, or ethyline alcohol, is diatomic; C_3H_5 $(O\ H)_3$, or glycerin, is triatomic, etc. We do not know what you mean by "low form" of alcohol; glycerin, the last named alcohol, is more highly constituted than the former.

How are photographs fastened to glass for the new style of oil painting? A. Cover the picture with a fine cloth, and remove all air bubbles by means of a soft rubber roller.

(33) W. B. W. asks: How can I make a petrifying solution to make vegetable tissues hard and durable? A. The time required for ordinary petrifaction renders its artificial application impracticable. There are various methods of metalizing leaves, etc., usually by electro-deposition of the metal, which, when properly applied, copy perfectly. These may be afterwards enameled to suit.

(34) J. D. E. asks: 1. What are the sizes and distances apart of the lenses in the eyepiece illustrated in SCIENTIFIC AMERICAN SUPPLEMENT, vol. 1? A. For medium power, focus of 1st lens, 1·30 inch: focus of 2d lens, 1·30 inch; focus of 3d lens, 1·40 inch; focus of 4th lens, 1·00 inch. Distance between 1st and 2d lens, 1·73 inch; distance between 2d and 3d lens, 2·25 inch; distance between 3d and 4th lens, 1·47 inch. Diameter of 1st and 2d lens, 0·48 inch; diameter of 3d lens, 0·68 inch; diameter of 4th lens, 0·34 inch. Distance of diaphragm from 1st lens, 1·45 inch; aperture of diaphragm between 1st and 2d lens, 0·08 inch; aperture of diaphragm between 3d and 4th lens, 0·46 inch; distance of cap from 4th lens, 0·30 inch; aperture of cap, 0·17 inch. 2. Should there be a diaphragm at the focus of the object glass? A. There should be diaphragms in the tube to cut off the reflections from the inside. 3. What is the ratio between achromatic lenses of different foci? A. In telescopic objectives the magnifying power varies directly as the focal length. If the focal length is double, the magnifying power is double. 4. Is it necessary to have the focus of the field lens of the Huyghenian eyepiece longer than that of the eye lens? A. Yes. 5. Is it necessary to have the rays of light parallel when they enter the eye? A. They should be nearly enough parallel to enable the eye to bring the object to a focus.

(35) E. P. M. asks: How can I soften some such substance as black hard rubber so as to mold it into small round tickets, with letters on them? A. The rubber is usually formed into the shape desired while still soft and warm, before vulcanization.

(36) H. N. R. asks: 1. Which is the most powerful, a reflecting or refracting telescope? A. A refracting one. 2. Can I get one which will distinguish objects 16 miles distant for $30? A. Yes. 3. Where can I get it? A. Address the opticians who advertise in our columns. 4. Would it be too long to carry? A. No. 5. Would it be a night as well as a day glass? A. Yes.

(37) A. L. F. asks: What is common pitch? A. It is the residue remaining after the removal of certain volatile bodies by distillation from the so-called Stockholm tar. The tar is originally obtained by a kind of rude distillation of the resinous wood of the pine, in turf-covered kilns.

(38) O. J. H. asks: What is Paris green? A. It is the aceto-arsenite of copper, and is the most poisonous of any of the combinations of arsenic.

(39) F. M. W. asks: Is there such an instrument as a night glass? A. The night glass (telescope), properly speaking, differs from the day glass only in the dimensions of its objectives and in some cases the use of an eyepiece of lower power. Ordinarily the so-called day and night glasses do not differ in any respect.

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

T. A. H.—Nos. 1, 2, and 3 are sulphide of iron. No. 4 is sand containing sulphide of iron, oxide of iron, alumina, and clay.—D. S. V.—It is chlorite with felspar, and is of no value.—J. S. M.=The presence of the sand is probably due to the decomposition of certain silicates at the source of the spring, the finely divided silica being brought to the surface by the mechanical force of the water, and in some cases deposited. It is not of sufficient purity to be of value even for glass making.—S. S.—The powder consists principally of sesquioxide of iron, together with a little alumina and sand. We found neither gold nor silver.—P., of Gold Hill, Nevada.—It is a clay containing lime. We do not think it contains any metal in paying quantities. A complete analysis would be required to determine all its constituents.—W. H. W.—It is galena, sulphuret of lead.—J. M.—The very small piece appears to be an artificial product. It contains a considerable percentage of copper.—J. McG.—A complete analysis of the beef did not detect any poisonous matter.—J. F. W.—No. 1 is mica schist. No. 2 is hornblende. No.3 is chrysoprase-chalcedony, whose color is due to nickel. No. 4 is dolomite, a magnesian limestone. No. 5 is rutile—titanic acid. No. 6 is felspar mica. No. 7 is a variety of basalt. No. 8 is quartz. No. 9 is impure clay. No. 10 is granite. Nos. 11 and 13 are semi-decomposed granite. No. 12 is quartz. No. 14 is flint. No. 15 is clay containing iron. Nos.16 and 17 are hornblende. No. 18 appears to be a specimen of chlorite, a silicate of magnesia. No. 19 is magnesian limestone.—E. E. Y.—It is a talcose rock containing sulphide of iron, which has gradually suffered partial decomposition; it is not valuable.—J. T.—It is an impure clay containing oxide of iron and sand.—A. W. S.—It contains, or has been in contact while heated with, sand or clay. The scoria consists of silicates of lime, alumina, and iron, together with caustic lime.—S. E. E.—No. 1 is hematite—an iron ore. No. 2 contains oxide of manganese.—No. 3 is hornblende.—R. C.—The yellow body is sulphide of iron. The white, carbonate of lime. The hard dark colored piece appears to be chalcedony. The fourth is a piece of scoria.—Cairo, Ill.—It is impure kaolin, a silicate of alumina.—The two specimens in match box, marked "Alpha" and "Clara," are quartz rock and hematite iron ore.

J. C. R. asks: In what year did the grasshoppers commence their destructive work in this country?—W. Z. R. and others ask: What is haitra, which you mention as a new size for cotton cloth?

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 Accumulation of the World. By S. A.
On Bevel Gears. By H. E.

Also inquiries and answers from the following:
W. F. W.—L. W. P.—B. T. K.—P. F.—H. H.—J. B.—W. W. C.—F. M., Jr.—W. D. K.—W. K. P.—M. A. G.—E. G.—P. S. K.

HINTS TO CORRESPONDENTS.

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

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

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INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 22, 1876,

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Addressing machine, J. M. Kennard	181,270
Alarm, fire, A. F. Eells	181,323
Auger, post hole, L. R. Hitchcock	181,264
Bale tie, W. Wilkinson	181,385
Ba ng manure, etc., J. B. Archer	181,389
Barrel, D. F. Bowker	181,241
rrel, sspool, Keese *et al*	181,269
Barrel stand, D. Scott	181,366
Bed bottom spring, W. S. Reynolds	181,517
Bedstead, wardrobe, C. Kilburn	181,450
Billiard chalk and ball holder, R. Martinez	181,354
Bluing, liquid laundry, T. S. Robinson	181,282
Bobbin, C. Hardy	181,436
Boiler attachment, C. M. Van Tine	181,501
Boiler, culinary, J. Bevin	181,396
Boiler flue brush, J, H. Davis	181,416
Boiler furnace, steam, B. J. Hobson	181,440
Boiler compound, scale-removing, R. R. Taylor.	181,373
Boiling apparatus. J. H. Corey	181,249
Bolts, etc., making, Le Blanc *et al*	181,453
Boot-lasting apparatus, D. Morey	181,464
Boot, moccasin, S. T. Hutchins	181,444
Bridges, etc., raising, Clark *et al*	181,409
Brooms, J.F. Lee, Jr.	181,454, 181,455
Buckle, P. Burns	181,407
Bung, W. W. Crooker	181,317
Bureau, J. Isakson	181,445
Burner, lamp, H. C. Scott	181,285
Butter worker, H. O. Mason	181,274
Candlestick, miner's, Quinliven & Linebarger	181,362
Cans, labeling fruit, J. Hinkley	181,340
Car axle lubricator, J. B. Flynt	181,428
Car brake pad, Russell & Shank	181,482
Car coupling, C. Derrick	181,253
Car coupling, A. Scoles	181,484
Car, discharging, J. W. McDonald	181,460
Car, refrigerating, J. A. Ayer	181,391
Car unloader, grain, G. M. Moulton	181,495
Car ventilator, W. Foglesong	181,429
Car wheels, casting, N. Washburn	181,504
Cars, feed trough for stock, Z. Street	181,495
Cars, etc., heater for, M. W. Hazelton	181,437
Cars, etc., ventilating, W. S. Andrews	181,240
Cartridges, capping, Burton *et al*	181,309
Cartridge cases, making, I. M. Milbank	181,356
Cartridge shells, testing, Salisbury & Wells	181,364
Chain, ornamental, S. Davidson	181,417
Chain, ornamental, J. L. Heeley	181,438
Chain, ornamental, P. E. Witherell	181,511
Chest protector, lady's, H. Hayward	181,261
Churn, L. Blust	181,400
Churn, J. Campbell	181,311
Cigar mold, N. Du Brul (r)	7,269
Clevis, spring, J. F. Chase	181,313
Clod crusher and drag, H. Feenders	181,427
Clothes dryer, J. P. Howell	181,442
Clothes dryer, O. B. Lee	181,351
Clothes pounder, R. J. Pumphrey	181,474
Clothes wringer, F. Way	181,505
Cock, stop and waste, G. Veale. Jr.	181,502
Coloring cotton and wool, Rice & Arnold	181,479
Cooler, milk, W. H. Hyde	181,347
Corset, C. A. Griswold	181,330
Cotton cleaner, A. J. Lee	181,352
Crackers, packing case for, J. Garneau, Sr.	181,329
Cradle, wire, E. Rollert	181,481
Crib and table, M. C. Urquhart	181,292
Cultivator, J. C. Bannigan	181,302
Cultivator, C. L. Carter	181,245
Cultivator, D. C. Stover	181,494
Cutting index sheets, S. M. Simons	181,290
Dental foil, R. S. Williams	181,508
Dental plugger, Snow & Lewis (r)	7,274
Dentist's vulcanizer, J. L. McDermut (r)	7,275
Desk, writing, Keys & Taylor	181,449
Digger, potato, A. J. Nellis	181,467
Dividers, A. Gruber	181,331
Door fastener, J. D. King	181,271
Drawing board, S. James	181,348
Drill, rock, E. Winchester	181,386
Earth closet, J. W. Beyron	181,397
Earth closet, R. S. Williams	181,507
Earth pulverizer, J. M. Kendall	181,448
Egg box, G. W. Stevens	181,371
Electric machine, W. Hochhausen	181,342
Elevated way, H. W. Farley	181,426
Elevator and purifier, water, C. Hartzell	181,336
Elevator belts for buckets, F. H. C. Mey	181,355
Elevator, hod, W. Smith	181,488
Elevator, hydraulic, M. P. Higgins	181,263
Elevator tower, L. B. Sawyer	181,283
Elevator tripping bucket, coal, J. R. Fitzhugh	181,516
Embankments, forming, Swift & O'Neale	181,372
Engine, blowing, P. L. Weimer	181,295
Engine, steam, A. R. Crihfield	181,315
Engine balanced valve, J. Fairburn	181,325
Engine governor, J. D. Willoughby	181,509
Engine valve, steam-moved, A. J. Stevens	181,370
Fan, J. E. Young	181,513
Fare box, W. E. Prall	181,281
Fence, barbed, R. Ford	181,328
Fence wire, barbed, J. F. Glidden	181,433
Fertilizing, treating refuse for, J. Bonfield	181,402
Fiber, separating, J. B. Vogel	181,382
Fire arm, breech-loading, H. J. Altman	181,301
Fire extinguisher, J. H. Connelly	181,414
Fire place frame, Bargis & Bell	181,395
Fires in oil tanks, extinguishing, J. H. Connelly	181,413
Fishing, trolling hook for, H. C. Brush	181,308
Furnace for assaying, T. M. Berge	181,304
Furnace gases, etc., purifying, Connelly *et al.* (r).	7,268
Furnace, soldering, F. C. & C. E. Smith	181,489
Gage, carpenter's, C. H. B. Hutchinson	181,345
Gas and water pipe case, F. Jarecki	181,349
Gas apparatus, R. Dean	181,418
Gas, generating carbonic acid, A. Kayser	181,268
Gas burner, F. A. Seaver	181,485
Gas lighting, automatic, W. W. Hannah	181,260
Gas fixture, C. Y. Taylor	181,496
Gas, making, H. W. C. Tweddle	181,499
Gas purifier, P. Munzinger	181,276
Glassware, press for molding, J. Haley	181,434
Grate, J. R. Case	181,246
Gun stock, adjustable, A. Sherman	181,289
Harness saddle and check hook, P. Burns	181,406
Harrow, A. J. Upham	181,379
Harvester, Rawson, Thacher, & Rawson	181,477
Harvester, corn, Hunt & Bryan	181,443
Harvester, platform adjustment, S. Noxon, Jr.	181,359
Hay elevator, J. R. Fitzhugh	181,515
Hay tedder, W. C. Gifford (r)	7,270
Health lift, H. H. Evarts	181,424
Heater, fire place, S. Musser	181,277
Heater for cars, etc., M. W. Hazelton	181,437
Hoe, wheel, R. Vampill	181,380
Hoof trimmer, G. Greiner	181,259
Horse detaching device, M. V. B. Walker	181,503
Horseshoes, removing burr from, C. H. Perkins	181,279
Hydrant, J. E. Scanlan	181,483
Hydrant, L. L. Treman	181,378
Hydro-extractor, W. P. Uhlinger	181,500
Ice crushing machine, D. W. Low	181,273
Illuminating apparatus, F. Darracott	181,252
Indicator, punching, W. Welch (r)	7,277
Indicator, station, C. O. Ficht	181,256
Injector, G. H. Little (r)	7,271
Jack, lifting, H. A. Curtis	181,251
Jack, wagon, F. A. Cleland	181,410
Kettle, camp, A. A. Gervais	181,431
Kiln, brick, E. W. Bingham	181,399
Ladder, extension step, W. H. Bitter	181,305
Lamp collar, C. F. Spencer	181,491
Lamp lighting attachment, R. Biber	181,398
Lamp wick and burner, H. C. Scott	181,284
Land roller marker, W. V. Aldridge	181,300
Lathes, chuck for metal, A. B. Smith	181,369
Leather, tapering machine, J. & G. W. Settle	181,489
Leggings, F. L. Oakley	181,469
Leveling rod, G. L. Whitehouse	181,384
Loom temple, E. S. Stimpson	181,291
Marble, artificial, R. Guelton	181,332
Marble, polishing, D. C. Myers	181,466
Mill, fulling, J. Draper	181,254
Mop holder, Cubbage & Alexander	181,415
Musical instrument, Smith & Hamilton	181,490
Nail extractor, W. H. Tinker	181,374
Nail feeding machine, F. Toepfer	181,376
Nail plate feeder, F. A. Gleason	181,258
Nut lock, T. C. Conrad	181,314
Nut lock, D. Deshon	181,419
Nut lock, C. H. Everhart	181,425
Ores, etc., roasting, smelting, J. Duffey	181,322
Organ tremolo, read, H. L. Pierce	181,472
Overalls, Crocker & Sommerfeld	181,316
Pail, lard, J. Sears	181,286
Pails, machine for striping, S. R. Henry	181,338
Paper bag machine, C. H. Morgan (r)	7,273
Paper bag machine, S. E. Pettee (r)	7,275
Paper, composition paste for fly, J. Ralston	181,476
Paper-folding mechanism, L. C. Crowell	181,250
Paper pulp, saving alkali in, S. Brown	181,405
Pavement, S. Baird	181,392
Pea nut roaster, J. Esposito	181,324
Pen and pencil case, C. M. Johnson	181,447
Pipe molds, making, W. Smith	181,368
Plaiting machine, Robinson & Silsby	181,480
Plane, etc., tonguing. C. G. Miller	181,357
Planter and fertilizer, J. C. Fooshe	181,327
Planter, corn, Z. D. Waters	181,294
Planter, seed, P. Kranz	181,350
Plastering tool, A. A. Howe	181,344
Plow, W. Stephenson	181,493
Plow beam, adjustable, J. Pentreath	181,471
Pop corn balls, forming, G. A. Blodget	181,306
Power, transmitting, Williams & Carter	181,296
Press, cider, H. L. & S. M. Brown	181,243
Printed sheets, etc., receiving, J. D. Yost	181,387
Pulley or fly wheel clutch, R. A. York	181,514
Pump, J. S. Adams	181,299
Pump, G. W. Rhinehart	181,363
Pump, cattle, J. H. McConnell	181,459
Pump, chain, G. Blythe	181,401
Pump, chain, A. J. Purviance	181,475
Pump governor, J. S. Leas	181,452
Pump, steam, J. Cahill	181,408
Pump valve, W. H. Thomas	181,497
Pumping valve, for barrels, J. J. Lewis	181,457
Railway signal, electro-magnetic, Hall & Snow	181,435
Railway switch, W. E. Prall	181,280
Railway switch, link bar for, T. G. Armstrong	181,390
Rake, horse hay, H. H. Hatheway	181,337
Reel, twine, J. Clarke	181,247
Reflector, F. L. Senour	181,287
Refrigerator, J. F. Ferguson	181,326
Retort for distilling mercury, F. Gutzkow	181,333
Rolling rails, roll for, W. Evans	181,255
Sash holder, E. B. Hill	181,339
Saw buck, P. W. Hardwick	181,335
Saw, hand, Disston & Shoemaker	181,422
Saws, tab for gang, H. Disston	181,421
Sawing machine, firewood, W. A. Hodgkins	181,343
Sawing machine, lath, J. W. Calkins	181,310
Separator, grain, R. M. Becker	181,303
Separator, grain, P. E. Merrihew	181,462
Separator, shavings, E. Brown	181,404
Settee, B. A. Osgood	181,360
Shaft coupling, R. Poole	181,473
Sharpening machine, McLaren & Coventry	181,275
Shelf, adjustable, E. C. Donnell	181,320
Shoe pegs, making, O. Abell	181,298
Sidewalk, T. Hyatt	181,346
Sieve, metallic, G. Herring	181,262
Sink guard and cover combined, A. S. Hodges	181,265
Skate, J. A. Dodge	181,319
Sled, Brannock & Cleveland	181,403
Sleigh knee and beam socket, J. J. Cobb	181,248
Sling for packages, G. D. Stevens	181,492
Smoothing iron, self-heating, J. S. Hull	181,266
Solder-cutting machine, F. C. & C. E. Smith	181,367
Soldering furnace, F. C. & C. E. Smith	181,489
Spooling yarn guide, G. Draper	181,321
Spooling guide supporter, J. B. Bancroft	181,394
Squaring tool, frame, J. Cleveland	181,411
Stamp, hand, P. Ligbe	181,458
Steam or gas, absorbing noise of, T. Shaw	181,288
Stereoscope, Wilcox & Ryan	181,506
Stove, C. Baldwin	181,393
Stove pipe, G. Wright	181,297
Stove platform, M. De Yonge	181,420
Surveying instrument, W. Kuebler	181,451
Suspenders, J. B. Sharp	181,487
Tank, liquid-measuring, B. Williams	181,510
Teaching singing, G. N. Carrozzi	181,312
Telegraph signal box, J. H. C. Watts	181,383
Telegraph, perforator, G. L. Anders	181,239
Tobacco cutter, J. G. Perry	181,361
Tobacco, making plug, C. Worley	181,512
Toy cannon, S. R. Hibbard	181,341
Trap, animal, C. R. Jenne	181,446
Tube-stretching machine, J. T. Connelly	181,412
Tunnel, subaqueous, J. C. Trautwine	181,498
Tweer, M. Lester	181,456
Tweer, I. S. Van Winkle	181,381
Type-writing machine, G. H. Morgan	181,463
Umbrella drip cup, Vincent & McKinny (r)	7,276
Valve, balanced, L. H. Hall	181,334
Valve gear, G. A. C. Bremme	181,242
Valve, stop, C. Jenkins	181,267
Vehicle draft appliance, J. L. Mueller	181,358
Vehicle head block, Z. Fischesser	181,257
Vehicle hub, N. L. Holmes	181,441
Vehicle pole attachment, B. C. Bradley	181,307
Vehicle, trotting, A. Hitchcock	181,439
Vehicles, spring connection for, W. Evans	181,423
Velocipede, S. Gilzinger	181,432
Veneers, cutting, J. D. McEachern	181,461
Ventilator, valve, W. Lane	181,272
Wagon brake, Adair & Babcock	181,388
Wagon brake lever, J. S. Fullerton	181,430
Wagon, manure, J. W. Town	181,375
Washing machine, S. Lindsley	181,353
Water, purifying, M. Nolden	181,468
Water wheel, Rector & Black	181,478
Water wheel, R. D. Sayre	181,365
Weather strip, H. R. Parker	181,470
Wells, lowering brick into, J. Campbell	181,244
Windmill, J. H. Painter	181,278
Windmill, G. H. Wallace	181,293
Window scaffold, H. C. Traphagen	181,377
Window screen, A. B. Davis	181,318

DESIGNS PATENTED.

9,449.—SHAWL PIN.—L. S. Beals, Astoria, N. Y.
9,450.—FOUNTAIN RIMS.—J. W. Fiske, New York city.
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9,452.—CARPETS.—J. Hamer, Dutchess county, N. Y.
9,453.—CARPETS.—A. Heald, Philadelphia, Pa.
9,454.—BELFRY.—M. Hild, Philadelphia, Pa.
9,455.—JACKET.—G. F. Hollis, Boston, Mass.
9,456 to 9,462.—CARRIAGE STEPS.—D. A. Kimbark, Chicago, Ill.
9,463.—SHIRT FRONTS.—A. Plant, New York city.
9,464 to 9,472.—FABRIC.—R. Scott *et al.*, Lawrence, Mass.

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