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A NEW LIGHT DRAFT PROPELLER.

The principal demand which ship constructors find themselves called upon to meet at the present time is for small swift screw propellers. Pleasure vessels of this description have been constructed in large numbers both in Europe and in this country; and the speed obtained, through the progress made both in modeling the hull and in fitting thereto engines of maximum power yet of most compact form, is certainly remarkable when the small size of the craft is considered. The success thus attained has suggested the possibility of securing like qualities in the medium-sized vessels used for commercial purposes, thus bridging over the gap between the light and fast screw steamer and the small steam yacht, which hitherto has formed the stronghold of the now fast disappearing paddle wheel. The vessels occupying this intermediary position include ferry boats, river steamers, coasters, and the like, the first necessity in which is light draft of water, a cardinal requirement which, when the large carrying capacity and other requisites are considered, at once militates against the use of the screw. It will be seen, therefore, that the problem of a light draft screw steamer is by no means an easy one to solve; but on the other hand, the advantages to be gained by its solution are amply sufficient to warrant thorough study and investigation. That such a course will in the end lead to the desired result is clear from the fact that we are now enabled to lay before our readers one interesting instance of a vessel constructed under the required conditions and meeting all the requirements of actual usage in a thoroughly satisfactory manner.

The Geneva—represented in the engraving—has recently been built for the Kingston and Cape Vincent (Canada) Ferry Company, by Messrs. George Chaffey & Brother, of Portsmouth, Ontario. The depth of water of Lake Ontario, between the above named points, is such as to necessitate a light draft vessel; and at the same time a craft sufficiently fast to beat the best boat in the Company's service was demanded. The general dimensions laid down were as follows: Length over all 103 feet, beam on deck 20 feet, draft forward 3 feet 6 inches, aft 4 feet 4 inches. The vessel accom-

modates on her forward deck fifty head of cattle, and in her cabins and on the upper deck four hundred passengers. The high pressure engine, also built by the same firm, is of the ordinary type of inverted single cylinder, 14x13 stroke, constructed in the lightest manner consistent with strength: the rods, crosshead, and shaft being of steel. There is a return tubular boiler entirely of Lowmoor iron, 9 feet 3 inches long by 9 feet in height and 5 feet in diameter, containing 157 return tubes, each 2½ inches by 7 feet long. One and a half tons of anthracite coal is consumed per 100 miles run. This is the average consumption for the season, and is very small considering that the fires are kept in night and day, and that the cabins are heated by steam from the boiler. The propeller is a Chaffey wheel, 4 feet 4 inches in diameter, with 7 feet 6 inches pitch.

On the trial trip over a measured distance of 2½ miles, the Geneva ran at the rate of 14½ miles per hour, the engine making 208 revolutions with 100 lbs. of steam. She is now capable of running 15 miles per hour, and has beaten, we are informed, the fastest boats in the vicinity by over two miles per hour, despite the fact that, for the latter, speeds varying from 16 to 18 knots are claimed.

The lines of the Geneva's model are of great beauty. A noticeable fact is that, while running at the height of her speed, the vessel does not change the water line to any appreciable extent, but maintains the same trim as when at rest. This is remarkable, inasmuch as screw steamers ordinarily, when running at high speeds, settle aft, while many present the appearance of moving up hill.

The builders above named have already achieved considerable reputation for their steam yachts and pleasure vessels, all of which are notable for speed and beauty of model. Parties interested in the improved construction illustrated in the case of the Geneva may obtain further particulars by addressing Messrs. Chaffey & Brother, as above.

English Fire Engines.

A series of trials of Messrs. Merryweather & Sons' new steam fire engine lately took place at Devonport Dockyard, the Admiral, Superintendent, and several heads of the various

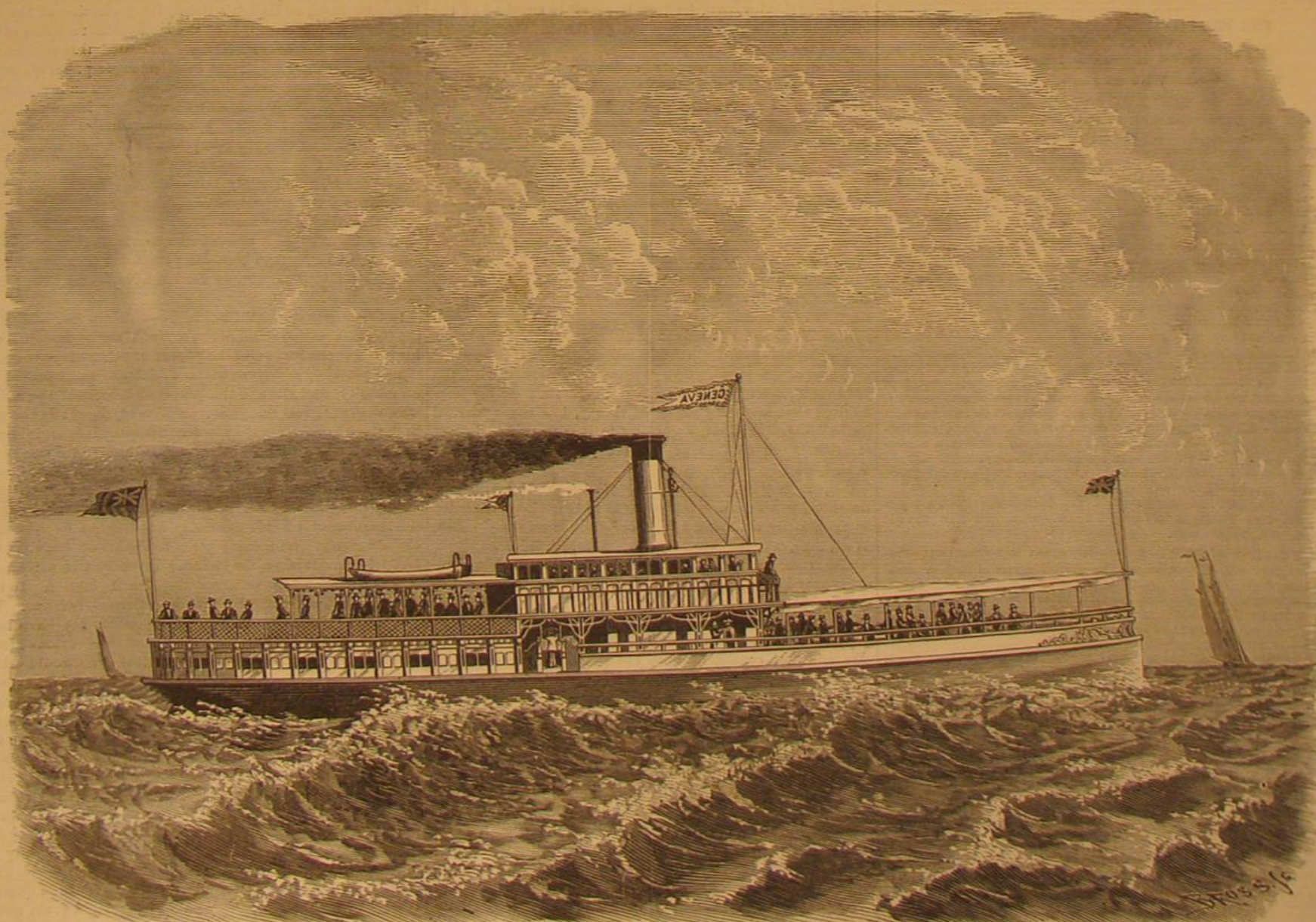
departments being present. The engine being placed along side the basin, and four lengths of suction pipe connected, a most severe test of raising the water through this vertical lift (32 feet) was satisfactorily accomplished. Steam was raised to 40 lbs. pressure in 5½ minutes, and to 120 lbs in 11 minutes. Two jets of water, 1½ inch in diameter, were thrown through 200 feet of hose to a vertical height, estimated at 170 feet, with a mean water pressure of 100 lbs. on the square inch. After pumping sea water, the engine was then removed to take its supply from the dockyard fresh water service. Several interesting tests took place, one notably being that a 2 inch solid jet of water was projected over the various buildings.

Mr. Thomas Fearn.

The Birmingham (England) *Gazette*, announcing the death of Mr. Thomas Fearn, says: "Mr. Fearn may be said to have been the inventor of the process known as electro-metallurgy, the patent for which he disposed of to the Messrs. Elkington, and which he was instrumental in introducing to every part of the Continent. He studied at the Queen's College, Birmingham, afterwards at Paris, and for some time was a distinguished pupil of the well known German chemist, Dr. Liebig, with whom he formed a lasting friendship. He was well known to the leading electro-metallurgists of Paris, Vienna, Berlin, and Cologne, and in Birmingham his society was courted, not only for his bright and far-reaching intelligence, but for his kindly and unostentatious geniality."

San Fernando Tunnel.

The tunnel through the San Fernando mountains has just been completed, and is worthy of notice, as it is by far the largest on the Pacific coast. Its length is 6,966 feet, while the longest tunnel on the Central Pacific Railroad, in crossing the Sierra, is not over 1,200 feet. It is not two years since the first borings were made, and since then many unforeseen difficulties have had to be encountered. From the character of the rock and the enormous pressure upon the timbers placed as supports, the tunnel will have to be lined with strong masonry throughout.



THE GENEVA—A NEW LIGHT DRAFT PROPELLER.

Another illustration of the very great importance of some little inventions is found in the galvanometer already alluded to. It saved the first Atlantic cable from being a complete and utter failure, and so demonstrated to the world the grand fact that submarine telegraphy through long distances was not chimerical: yet it consisted essentially of nothing more than a slender magnetic needle, three eighths of an inch long, carrying a circular mirror about a quarter of an inch in diameter, the whole—weighing a grain and a half—being suspended by a film of silk. Without this prompt and acutely sensitive little indicator of electric dis-

turbance, telegraphing through great lengths of submerged wire would have been practically impossible, owing to the length of time required for each signal wave: and it is not at all unlikely that, had Sir William's invention not been on hand in the nick of time, the Atlantic cable would not only have been abandoned as a hopeless failure, financially considered, but capitalists would have declined to sink any more money in that sort of enterprise. But its usefulness did not end there; it has since been and must ever continue to be of the utmost importance in ocean cabling, and in all important electrical operations on land, whether practical or purely investigative.

THE SPIRITUAL SLATE.

These are sorry days for spiritualists. Scarcely a week passes but some shining light in their troubled world is shattered, some "unimpeachable" instrument of the spirits and mediator between poor humanity and the angelic hosts is detected in vulgar trickery. And what is more discouraging, disaster seems ever to press hard upon delusive triumphs.

The latest misadventure is one of the saddest. Just when, by a clever trick, the subject had been sprung upon the British Association, and the champion performer and wonder worker of the sect, Dr. Slade, had been advertised beyond precedent, a mousing zoologist plots with a friend of like character, and the result is

"One more triumph for devils and sorrow for angels,"

one more opportunity for the unbelieving to wag their heads, and cry—Next!

The story of Dr. Slade's experience in this country and in England is an interesting one; and as the English papers have lately been much occupied with his exploits, his downfall is more than ordinarily significant. Most of our readers have doubtless heard of his method, which is specially his own. He takes a slate—that is, he used to take a slate, and very likely still does the same, exposure being no bar to confidence on the part of the faithful—he takes a slate, wipes it clean, puts a bit of pencil on it, then places it under a table, on the questioner's head, behind his back, or elsewhere, and straightway a scratching sound is heard, and in due time a more or less clearly written message is produced: fee five dollars.

Everything appears to be frank, honest, and above-board, also very mysterious and altogether inexplicable, most observers declared, except on the hypothesis of "spirit" intervention. But there was one circumstance that the sceptical did not like the look of. It was a common thing for spiritualists to claim that they had known the spirits to write for Dr. Slade on the inside of a double slate when the two leaves were securely fastened together. But when an unbeliever offered such a test, the honest Doctor would candidly express his doubts of success; the conditions of the ordinary *séance* were exacting enough, he would say, and the intelligences which governed him would have nothing to do with locked slates, or the chemically prepared or otherwise doctored slates which too particular Yankees frequently brought him. Wary intelligences! and eke with tender sensibilities!

Nevertheless they have come to grief. One object of the paper read before the biological section of the British Association was to secure the appointment of a committee to investigate spiritualism with the hope to bring its vagaries under the protecting wings of Science. Particularly, the "phenomena" developed in the presence and through the ministrations of Dr. Slade were to be enquired into. The motion failed on account of the intolerance of certain bigoted scientists of the ungodly sort.

But the examination was made scientifically for all that—by Dr. E. Ray Lankester, F. R. S., and Professor of Zoology in University College, London, a gentleman well known to the reading public. Dr. Lankester visited Slade several times, and, like the venerable Dr. Carpenter, was "very much shaken" by what he saw. In fact he simulated considerable agitation and an ardent belief in the mysterious nature of what he saw and heard. All the time he studied Dr. Slade's performances closely, and at last he thought he saw through them. So he appointed another interview, and went for his friend Dr. Horatio B. Donkin, of Queen's College, Oxford, one of the physicians of Westminster Hospital, to whom he explained his hypothesis, and arranged for a demonstration of it next day.

The hypothesis was simply that Dr. Slade himself wrote the messages, which were of two sorts, one short and sprawling, the other long and with the characters well formed: the first Dr. Lankester believed were written with the finger of one hand as the slate was being held under the table, the second while the slate was resting on Dr. Slade's knee, concealed by the table, the operator being ostensibly engaged meantime in preparing the pencil for the "spirits" to write with, and so on. The test proposed was simply to seize the slate after it was cleaned and before it was put under the table—that is, at a time previous to its submission to the "spirits."

The thing was done, after two or three messages had been regularly received. With Dr. Slade's permission Dr. Lankester was to hold the slate under the table; instead, he accused Slade of having already written the expected reply, and on turning the slate over, found the charge sustained.

"To any one not predisposed to believe in spirit agency at all hazards," writes Dr. Donkin to the *London Times*, "this *séance* is sufficient." We have not the slightest notion, however, that Dr. Slade's standing among the mass of spiritualists will be affected in the least. It is said that, when the exposure was made, he simply remarked: "You see that you have been paid in your own coin: the spirits will not come

to people without faith!" and all true believers will accept the saying as not only satisfactory but grandly heroic.

Verily Faith, even more than Charity, hopeth all things, believeth all things, endureth all things!

THE INTER-MERCURIAL PLANET.

Quite a stir has recently occurred in the astronomical world, owing to the famous French astronomer M. Leverrier having telegraphed to the various observatories in Europe and America that it was probable that the supposed inter-Mercurial planet Vulcan would traverse the sun's disk in October. M. Leverrier at the same time requested that astronomers would watch most carefully for the phenomenon, and this, it is hardly necessary to add, has been done. The result, however, is disappointing, as the planet failed to appear, and the doubt as to its existence remains as strong as ever, although, on the other hand, the possibility of there being such another world is by no means unreasonable. It will be interesting, therefore, in the present connection, briefly to review the magnificent labors of M. Leverrier, as an incidental portion of which the hypothesis of a planet, nearer the sun than Mercury, suggested itself to his mind. And these labors have earned for the distinguished scientist the title of the "weigher of worlds," for all the great orbs which circle about the sun have been gaged by him as accurately as if they had been placed in the scale pan of some stupendous balance.

The vast work which we are about to sketch began on September 16, 1839; it was substantially completed on December 21, 1875; and the fact was announced by M. Leverrier in person, at the session of the French Academy at the last mentioned date. Every schoolboy knows that the sun is the central ruler of our planetary system, and that his mass is so enormously in excess of that of all the planets taken together that he is capable of swaying their motion without being himself disturbed. So colossal is the sun's attractive force that the like force which the planets exercise upon one another becomes extremely small. The sun's power over Saturn is 250 times that of Jupiter, even when the planets are nearest together; and as there is no disturbance in the whole solar system greater than that resulting from the mutual influence of Jupiter and Saturn, it is unnecessary to proceed further to show the paramount rule of sun. But small as these influences are, we cannot neglect them, for were the planets ruled absolutely by the sun they would go on circling in the same orbits, changelessly and for ever. Now if we consider that the more massive the planet is, the more potently it will disturb its neighbors, it follows that, even if we cannot tell exactly how much this disturbance amounts to, we can tell how large the planet's mass is, compared, say, with the earth's. Thus we can consider how much Venus disturbs Mercury, and thus infer her mass, and a chance comet may be affected by Venus, enough to afford us means for another determination. If our results over several observations failed to agree, we should search why; we should assume an error, which must be hunted down; and thus we should be led to one of two things, either to find our mistake, or else to discover some fact, before unsuspected, which has, unknown to us, become a factor in our problem.

This is Leverrier's method of dealing with planets, in a nutshell. Seven planets were known when he began his work; and finding that the tables of their motions in common use failed to rigorously accord with results of observation, he began the gigantic and complicated task of unraveling all the forces which produce the planetary movements. We can no more than summarize his results. Beginning with the earth, he reviewed nine thousand distinct observations of the sun; and by carefully estimating the sun's apparent monthly displacement, he reduced the accepted estimates of the distance of our luminary by between three and four million miles. Then he analyzed the observed motions of Uranus, and here he made the grand discovery of the unknown factor above referred to, which in this case could be none other than another great planet, producing the unaccountable Uranian perturbations. Concerning a hypothetical planet, he calculated its position; and aided by the lucky circumstance that but a very short time had elapsed since Uranus and the new planet were in conjunction, on pointing his telescope to the supposed position, he found Neptune. This magnificent result, shedding of itself enough glory on the astronomer to render him famous for ever, was, as we have seen, but incidental to the whole work, which has likewise included analyses of the motions of Mars, influenced by the great asteroid ring, and of Mercury, which has resulted in the noting of the remarkable perturbations, which are only to be accounted for by the existence of some inter-Mercurial matter, or probably by the existence of the supposed Vulcan. To the latter view, M. Leverrier, arguing very justly from the analogies of the discovery of Neptune, inclines, and therefore he is constantly on the alert for any visible indication of the hypothetical planet.

In 1859 M. Lescaubault, a physician in Paris, announced that he had witnessed the black disk of an unknown planet cross the sun. Leverrier at once investigated the details of the observations, and, despite the fact that the instruments used were of the roughest description, deemed the proof adduced conclusive that the planet had been seen: but Liais, an eminent Brazilian astronomer, subsequently reported that, at the reported time of transit, he likewise was examining the sun's face, with a very superior instrument, and that no black spot was visible.

There are few other recorded instances up to the present time where Vulcan is claimed to have been seen. On August 28 last, M. Leverrier communicated to the French Academy of Sciences, a letter from M. Wolf, a well known Swiss astrono-

mer, in which Wolf said that Weber in Prussia had seen a black spot crossing the sun on April 4, last. On the following day, Wolf, Schmidt (an astronomer in Athens, Greece), and Weber had all examined the solar disk, and no spot was then visible. Weber, unfortunately, did not note the rate of progression of the spot, nor has any one yet been able to find a solar photograph made at any observatory on April 4, so that there is no primary and positive evidence that the phenomenon was Vulcanian. On the other hand, there is secondary evidence to the effect that the spot disappeared within twenty-four hours, and that the period when it was seen would be that of the 148th transit, dating from the observation of Lescaubault, the Vulcanian year being 42.2 days. This, M. Leverrier deemed sufficiently important to warrant his making the general request noted in the first paragraph of this article. The result being as stated, the question still remains open, with the probabilities in favor of the halo of meteoric matter which is constantly about the sun being the cause of the Mercurial vagaries.

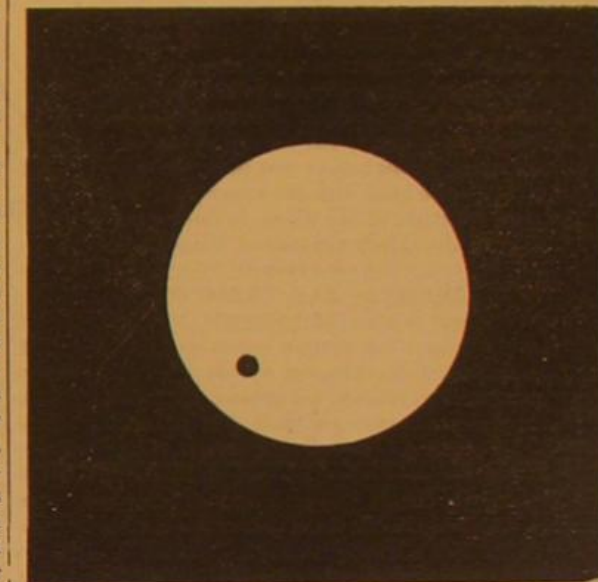
In this connection, however, the annexed letter of a correspondent details a phenomenon which is certainly worth considering.

To the Editor of the Scientific American:

The interest excited by the recent searches of the astronomers, for the supposed planet Vulcan, leads me to report to you the following observations made at Montclair, N. J.

On Sunday, July 23, 1876, at 3 P. M., I directed my telescope (2½ inch) towards the sun's disk in search of spots. As none had been seen for a considerable time previous, I rather congratulated myself on having at last found one, and on getting my instrument carefully focussed, was surprised to notice that, instead of the irregular, jagged form of common sun spots, this one was round.

It stood out on the lower left portion of the bright luminary, clear and sharp, as seen in the accompanying drawing.



Thinking that what I saw might be due to a defect in the lenses, I first rotated them in their tubes; but the round spot still kept the same place on the sun's disk. I then removed my object glasses, examined and cleaned them carefully. I did the same with my eyepiece lenses. On restoring them to their places in the tube, the same round body was still in view on the sun's disk. I called a friend to examine it with me. We studied it for some little time, until the clouds put an end to further observations. We concluded that we had chanced to hit upon a new kind of sun spot, perfectly round and black. We made no attempt to determine the motion of the spot.

A few days thereafter, on renewing my examination of the luminary, no spots were visible.

B. B.
New York, October 4, 1876.

It will be perceived that the date of this observation is prior to the time when Weber's report was first brought to M. Leverrier's knowledge; and hence our correspondent had none of the present excitement to influence his imagination. Nor could the phenomenon have been due to a spot, for, as is well known, this is the minimum period of solar eruptions, and the sun's face has been spotless for many months; besides, spots never appear as black dots, but have clearly marked and unmistakable characteristics.

It appears further that M. Leverrier did not definitely designate October 2 and 3 as the epoch when the transit might occur. In his communication to Professor Watson of Ann Arbor, he specified October 9 and 10. Now M. Leverrier cites with details some thirty observations made by astronomers since 1750, and he selects data obtained in 1820 and 1856, and combines them with the recent results of Weber's observation. This leads him to conclude that the Vulcanian year is not 42.2 days, but 28.00774 days, and the motion of the planet is expressed thus: $V = 15.2^\circ + 12.85359^\circ (j - 1750)$ in which the first term is the longitude and j represents the number of days elapsed since 1750. The orbit is circular, the ascending node being at $+12^\circ$, and the descending node at 195° . M. Leverrier now thinks that the transit will be visible on October 30. This date does not coincide with an even number of Vulcanian years of 28 days since our correspondent's observation. There is a discrepancy of two weeks; but on the other hand, there is an equal failure of coincidence with Weber's date, April 4.

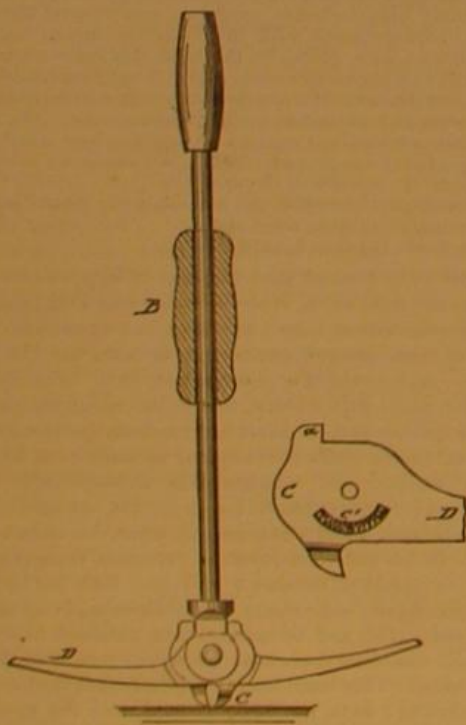
Since writing the above, we have learned that still another astronomer is to be added to the list of those who have seen Vulcan. Rev. E. R. Craven, of Newark, states that the late Professor Joseph S. Hubbard repeatedly assured him that he had observed the transit of an inter-Mercurial planet. He was at New Haven at the time, and was using the Yale College telescope. The transit was an entire surprise, and hence no notes were taken.

IMPROVED LOCOMOTIVE AND CAR STEAM BRAKE.

An ingenious brake mechanism has been devised by Mr. T. J. Shellhorn, of Marquette, Mich., and patented through the Scientific American Patent Agency, September 5, 1876. The steam cylinder, A, as shown in the illustration, is placed midway between the driving wheels of a locomotive or the wheels of a car truck. The steam is admitted to the cylinder by a pipe, *a*, entering midway between the cylinder heads, and acting simultaneously upon two pistons, B, that are arranged symmetrically in the cylinder, and acted upon by volute springs, B', of considerable power. The steam pipe, *a*, is carried up the boiler head to the steam dome, and the admission and exhaust of steam is controlled by a three-way cock. A drip valve, *b*, is arranged at the bottom of the cylinder, A. The piston rods are pivoted at their outer ends to brake levers, C, which force the brake heads and shoes, D, against the driving wheels, the leverage being obtained by the fulcrum rods, E; said rods are pivoted to the lower ends of the brake levers, and connected by a sleeve or nut, *d*, with interior right and left hand screw threads, for the purpose of adjusting the levers, C, from time to time, as required by the gradual wear of the shoes, and also for providing for the distances between the driving and other wheels in different locomotives and cars. The right and left hand sleeve or nut, *d*, is held in stationary position by jam nuts, *d'*. The brake heads, D, are fulcrumed at some distance above the fulcrum rods to the brake levers, and further connected to the same at their upper ends by pivoted clearance links, *e e*. The links, *e e*, are intended for the purpose of carrying back the brake heads or shoes, with the brake levers, out of the line of friction with the wheels when the brakes are released. The release of the brakes is effected jointly by the exhaustion of the pressure in the cylinder, the action of the volute springs upon the pistons, and the gravitation of the brake heads. The brake levers, C, are not made straight, but with an obtuse angle, and formed by the heel or part below the fulcrum of the brake head with the upper part. By this means the strain of the wheels is thrown upon the top of the axle boxes instead of upon the sides.

IMPROVED NAIL EXTRACTOR.

Mr. William H. Tinker, of Springfield, Mo., has patented through the Scientific American Patent Agency, August 22, 1876, an improved nail extractor, by which the nail is drawn with great facility without being bent, and which is illustrated in the accompanying engraving. B is a sliding handle weight, by which the jaws, C, are driven in the ordinary manner into the wood below the nail, to be then applied to the same by the double foot or leverage of the jaws. The jaws are fulcrumed to the lower part of the handle, and provided with symmetrically extending levers, D, that are opened by spiral springs, *C'*. The jaws, C, have shoulders, *a*, in the upper part, that come in contact with the handle or stock, A, and define the position of the levers. The double

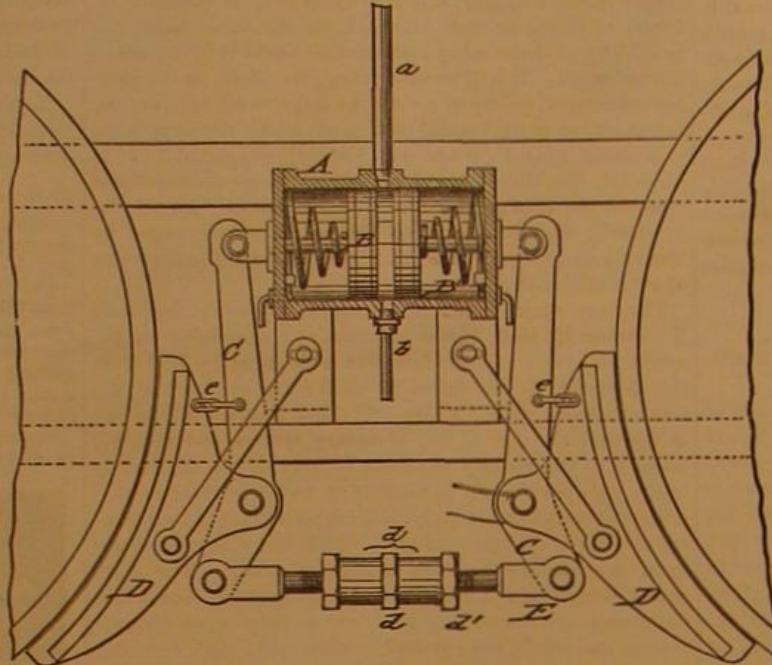


leverage admits the pulling of the nail in two different directions without removing the instrument. This allows the withdrawing of nails from hard or soft wood in an easier manner without bending the nail, as the same may be first loosened and afterward extracted.

Capital and Labor.

Ask any economist, and he will tell you that capital is the accumulation of past labor, intended to move or assist labor, and that it is either a transient or a permanent assistance, the former requiring constant renovation, the latter being of an enduring character. Ask him what labor is, and he will tell you that it is the power which intelligence gives man over the properties of matter and life by which muscular effort can make matter useful. It will be added that this power which the laborer is able to exercise over matter may be either the direct action of the man, or may be indi-

rectly exhibited upon certain inorganic and organic powers: in other words, that the workman may be plying his own muscles, or may be guiding animal power, or be using steam, wind, or any other natural motion which man is able to control and direct for his own ends. In technical language, economists speak of fixed and circulating capital, of muscular and nervous labor. All these definitions and distinctions, however, are not fundamental, but only denote tendencies under which the same facts appear in different forms, or in which one of the circumstances which accompanies the fact is exhibited in different degrees of intensity. Thus the labor of a manager is said to be nervous, that of a workman muscular. But unintelligent effort is of no avail, even for the commonest acts, nor can the sharpest intelli-

**SHELLHORN'S LOCOMOTIVE AND CAR STEAM BRAKE.**

gence give effect to its thoughts, except by means of muscular effort. No labor appears to be more characteristic of the brain than the thoughts of a poet or musician are, but both these personages must at least exercise the mechanical function of writing or speaking. Again, it is true that capital is the accumulation of past labor, embodied or condensed in material objects. With one exception, namely, land available for occupation or cultivation in densely peopled countries, there is no object whatever, which possesses value, that has not obtained its value by reason that labor has been expended on it. A sack of wheat, a bale of cotton, a barrel of wine, a wedge of gold, a house, or a spinning machine, possesses whatever value the market assigns to it by reason that labor has been expended on its production. It signifies nothing, from this point of view, whether the article is movable or has been gifted with qualities which cannot be recovered or resumed in their original form. In every case it is labor, and labor only, which confers on these objects those properties which economists recognize and comment on.—*Professor Thorold Rogers.*

The Electric-Harmonic Telegraphic System.

Although there has not been much said of late in regard to the electric-harmonic telegraph invention of Mr. Elisha Gray, constant progress has been made towards developing and perfecting it. Within the past year very important improvements have been made, which materially increase its value and reliability. Mr. Gray has been for several weeks past engaged in demonstrating the system on the wires of the Western Union Telegraph Company, and has certainly shown some remarkable results. On September 21, by invitation of that gentleman, we were present at an exhibition of it in the Western Union building, which was very successful. But one wire was employed, yet it required sixteen operators, eight at each end, to work this single wire. The wire employed was one of the Western Union wires between this city and Philadelphia.

The most important improvement effected by Mr. Gray, since we last noticed his invention, is the successful duplexing of his apparatus, so that messages can be sent simultaneously from each end of the line. With the apparatus manufactured at the present time, four messages can be sent simultaneously from each end of the wire. Upon the occasion mentioned, four operators were engaged in sending and four in receiving, and the same number were similarly employed in the Philadelphia office at the same time on the one wire. Thus eight messages were being simultaneously transmitted and received, at a speed equal to that obtained in ordinary working of a single circuit on one wire, without the slightest interference with each other. The principle upon which this system is based is that of the number of vibrations required to give a musical tone. By very ingenious and simple apparatus, this principle is utilized for the transmission of telegraphic signals simultaneously on a number of circuits over a single wire. The receiving instrument, for instance, which is adjusted to receive the vibrations required to constitute the musical note represented by A, will pick up the signals sent by the corresponding transmitter, but it is not affected by those transmitted at any other pitch.

It is impossible to give a very satisfactory description of the system, apparatus, and connections, without diagrams. We propose, before long, to give a full and accurate description, with the latest improvements, properly illustrated

of this system, which will doubtless be of great interest to all telegraphers. The importance of this invention can scarcely be overestimated. Although eight circuits only have been actually operated by it as yet, there seems to be no reason to doubt but that these may be increased, even to as many as thirty-two: that is, to as many as there are tones and semi-tones in the musical scale. It is in fact already duplexes the quadruplex in actual operation, and is more reliable and less difficult to operate than the quadruplex. Mr. Gray has spent several years in developing and perfecting his invention, and there can be no doubt but that it is destined to play an important part in the telegraphy in the future.—*The Telegrapher.*

Our Silk Industry.

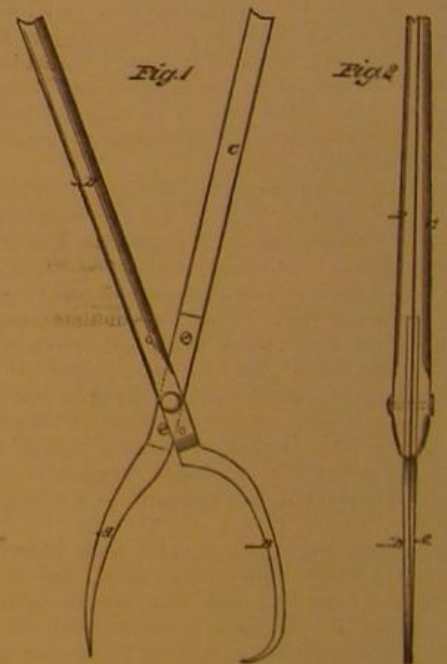
The English *Textile Manufacturer*, reviewing the progress of the silk industry in the United States, says that our manufactures of ribbons, etc., for 1875, were double those of 1874; and while other branches of industry were in a crippled state, the silk trade could offer occupation to a greater quantity of able regular workmen than usual, besides being able to afford higher prices. As characteristic of the increased activity of the manufacture in Paterson, N. J., last year, the immigration of English and French workmen is noted. The latter possess their own looms, which they take with them to work on their own account. The import of raw silk, in 1875, was 50 per cent greater than in 1874, and exceeded by 38,807 lbs. the corresponding exports of 1871: the amount in the latter year being the largest yet attained, except that in 1875.

Utilizing Unmarketable Cocoons.

Mrs. Bladen Neill, of London, England, has invented a new utilization of cocoons which are adjudged unfit for use in silk making, and has philanthropically turned her invention to such account as to make it the basis of remunerative labor for women. A certain proportion of every crop of cocoons is rejected, because, the chrysalis having become matured, the moth has made its escape, and thus the filaments at one end of the cocoons are cut through. The continuity of the thread being broken, it loses its value and is useless for reeling. Mrs. Neill sends to various parts of the world and gathers these faulty cocoons, boils them, and reels off the fragmentary filaments. These are sent to the spinners and made into a handsome silk yarn, which is dyed as required, and the material is issued to poor women who convert it into knit goods. The fabric thus produced is of such excellent quality that the demand already has far exceeded the supply.

A NEW FODDER FORK.

Mr. William M. Scotten, of Hall, Ind., is the inventor of an improved fodder fork, patented through the Scientific American Patent Agency, August 8, 1876. The object is to enable the substance to be firmly grasped and securely held while being handled. A and B are the two prongs or tines of the fork, which are pivoted to each other at their bases.



The prong, A, is slightly bent; and the prong, B, is made longer, and its point is bent inward into hook form, so that when brought together the points of the two prongs may meet. To the shanks or bases of the prongs, A B, are attached the handles, C D, which are made half round, so that when brought together they may form a round handle, as shown in Fig. 2, and so that the gripe upon the said handles may hold the prongs together. In using the fork, the prongs are opened, as shown in Fig. 1; the prong, A, is then thrust into the load, the hook prong, B, is closed upon it, and the load is taken to the desired place.

THE American Fish Commission recently held a convention in the Maryland State building in the Centennial grounds, at which Professor Baird stated that 8,000,000 young shad and 8,000,000 young salmon have been distributed in this country in the past year, and 600,000 eggs sent abroad. Mr. Livingstone Stone has just brought 4,000,000 salmon eggs from California.

SINGULAR ACCIDENT TO A TROUT.

The trout shown in the accompanying engraving was recently captured in England, having come to an untimely death. Mr. Frank Buckland, the indefatigable naturalist who edits *Land and Water*, states that the trout was found lying dead, on its back, with a dace fixed tight in its gills, and further says:

"The only interpretation that I can give of this accident is that the trout had rushed at the dace to eat him, and, seizing him by the head, had attempted to swallow him; the dace, objecting to this process, and possibly knowing by instinct that if he got into the trout's stomach he would never return therefrom alive, fought hard for his life; and seeing a possible way of escape through the aperture of the gills, he used his best efforts to pass through: fate, however, was against him, and the unfortunate dace became wedged among the gills of the trout, and both fish thus perished.

"When we consider the delicate structure of the swallowing apparatus in all animals, ourselves included, it is really wonderful that more accidents by choking do not take place. In our own persons the apparatus for preventing accidents of this kind are, indeed, most marvellous. The trachea or windpipe is situated immediately in front of the oesophagus, and every morsel of food and fluid we swallow has to pass over the opening of the trachea, which is in fact not unlike the slit of a money box, before it can get into the oesophagus or gullet. The pain and irritation caused by even a crumb or a drop of water getting by accident into the trachea is very great. We cannot, therefore, sufficiently admire the wonderful valve which the Creator has placed upon the top of the trachea. The valve is self-acting, and luckily for us does not depend upon any volition of our own. If it were not so, a person's whole time might be taken up in watching every morsel of food he put into his mouth. By a beneficent arrangement, the act of swallowing is quite as independent of the volition of ourselves as is the action of the heart, the power of thought, and the machinery of the human system in general. The same state of things that is found in the structure of the inhabitants of the land prevails also in the structure of the creatures which live in the water, and among them, as among land animals, an accident is very rare; the above drawing is therefore the more interesting, inasmuch as it shows that even fish are sometimes choked by the living prey on which they subsist."

Correspondence.

The Tripartition of an Angle.

To the Editor of the Scientific American:

Dividing an angle in two parts is one of the easiest operations in geometry; but the division of an angle into three equal parts is considered a difficult and an impossible one.

Let it be supposed that the angle, $A B C$, is divided into three equal parts by the lines, $B D$ and $B E$; then draw the arc, $A C$, and its chord; next draw the lines, $A D$, $A E$, $D E$, $D C$, $E C$, resulting in two isosceles triangles, $A E D$ and $D C E$. Studying the properties of these triangles, we find that their altitudes are the division lines. These lines, therefore, must divide the base lines in two halves, and stand rectangular upon them. Therefore, if $A D$ is really equal to $D E$, then $A F$ must $= F E$, and $D F$ be perpendicular to $A E$; and if $D E = E C$, then $D G = G C$, and $G E$ is perpendicular to $D C$.

The following is the construction and solution of the problem: The angle, $A B C$, is to be divided into three equal parts: 1. Draw the arc, $A C$, with any radius. 2. Draw the chord, $A C$. 3. Divide the angle, $A B C$, in two parts by the line, $B H$. 4, 5. Draw the lines $A H$ and $H C$. 6, 7. Draw semicircles, $A F B$ and $B G C$, over each side of the given angle. These semicircles have the property of dividing all lines (chords) drawn from A or C to the periphery, $A H C$, into two equal parts, because each of their radii is half that of $A B C$. 8. Draw $B I$ perpendicular to $H C$ in its middle, and $B M$ perpendicular to $A H$. 9. Make $L I = B K$. 10. Draw, with radius $H I$, the arc, $H G C$. 11. Draw $B E$ through the point, G , where the arc, $H G C$, intersects the semicircle, $B G C$, and the same on the other side of $B H$, where $B D$ is drawn through the intersecting point, F .

If the arc, $A H C$, is divided into a convenient number of equal parts, 8, 16, or so, of which M and K are two, draw $M C$, and $K N$ perpendicular to $M C$; then N is the nadir of the altitude of the triangle, $M C K$. In the same way more points are found, all lying in the circle, $H G C$, with the radius, $H I = B K + L K$.

Both conditions are really complied with; $C G = G D$ and $E G$ is perpendicular to $D C$; the triangle, $D C E$, is isosceles, and $D E = E C$; and further, $A D = D E$. Therefore we have $A D = D E = E C$, and angle $A B D = D B E = E B C$.

It remains to show that triangle $D C E$ is the only isosceles triangle that answers both of these conditions.

$M K C$ cannot be an isosceles triangle, because we made $C K = H K = H M = A D$, and therefore $C K$ is not equal to $K M$. In every triangle in consideration, one side must be parallel with the chord of the given angle, as $M K$, $A C$, $D E$,

Only one isosceles triangle fulfils this and the other conditions, and this is the one sought for.

In a similar way I tried to find the law for dividing an angle into n equal parts, when n is a prime number; but I am obliged to confess that I did not succeed. Nevertheless there is some law in these divisions. I found that the semicircle, $A F B$, is intersected in $\frac{n-1}{2}$ points by as many circles, the positions of which I cannot find, and there are as many parallel lines connecting the points of division. So 3 parts has 1, 5 parts 2, 7 parts 3, 11 parts 5, 31 parts 15. If n is an even number, for instance 6, then the problem is to be reduced to tripartitions, which must be made in each half. The semicircle is intersected in $2\frac{1}{2}$ points, that means



A TROUT CHOKED BY A DACE.

that one of the dividing radii goes through the points where the two semicircles cut each other, thus dividing the angle in two parts.

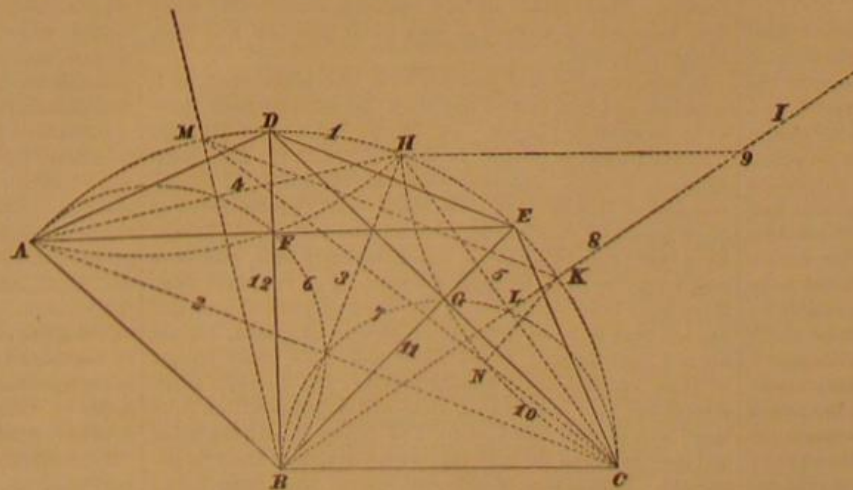
W. THIESE.

Rochester, N. Y.

A New Photographic Test Plate.

Mr. William A. Brice, of London, England, the inventor of the improved portable photographic apparatus illustrated in these columns not long ago, has patented through the Scientific American Patent Agency, September 12, 1876, a novel testing plate, which will enable photographers to determine with considerable certainty the quality of the chemicals employed, the quick or slow working of the lens, and to define whether the presence of "fog" or want of clearness in the picture is attributable to impurities of the chemicals, alkalinity of the bath, diffused light, over-exposure to light, or to other causes.

The invention consists of a frame with a sliding glass plate, to which are applied fixed pieces of transparent material superposed in layers of one, two, three, and more, in regular succession, to produce a greater or less obstacle to the passage of the light. This is set up between the lens and the sensitized plate, and the picture is then taken in the usual manner. The result is a picture which produces the light shade or shadow of the object to be photographed with the chemicals and lens, and with light of more or less the same actinic quality, intended to be used for the picture to be taken. When the picture is developed on this plate, it is, while visible, wholly divided into sections of unequal intensity, being more or less distinct according as the light has passed through one or more layers. The absence of fog where the light has been transmitted through several sheets of transparent material indicates that the chemicals are pure, that there is no diffused light, and that the nitrate bath is of proper acidity. If at that section details of the picture are clearly developed, it may be concluded that the exposure has been sufficient with the lens, light, and chemi-



als used. The second section of the testing plate, where the light passes through a less number of layers, gives more or less the same information, but indicates more clearly whether the exposure has been adapted to existing conditions or not. The next section indicates, if properly developed, what time, chemicals, etc., are to be used for the picture to be taken; while the middle or uncovered section indicates by the evident over-exposure that the lens is good and rapid in action, that the chemicals are in good condition, and that the light is sufficient in actinic power to produce good pictures with rapid exposure. The device is one which

photographers will doubtless find labor-saving and of much general assistance.

The Preparation of Salicylic Acid.

Cahours obtained salicylic acid in 1844, from methyl-salicylate, or oil of wintergreen (*Gaultheria procumbens*). Professors Kolbe and Lautermann in 1860 brought out their method of obtaining the acid from carbolic acid; but it was not until within the last year that Kolbe discovered its peculiar preserving and disinfecting properties. The manner of obtaining the acid from carbolic acid is as follows: The saturating capacity of a carbolic and also that of a soda lye is determined, and both are then mixed according to equivalents, so as to form sodic carbolate. The solution thus obtained is carefully evaporated to dryness, taking care that the dry mass sticking to the bottom of the vessel is constantly removed by scrapers, and that the mass itself is also constantly crushed, with a pestle or other tool, to facilitate its drying out, until at length the carbolate remains as a perfectly dry powder of a rose-red tint. Excess of carbolic acid gives always an inferior dark-looking residue, which, when it undergoes the final process of treatment with carbonic acid gas, gives far less salicylic acid than is in accordance with the amount of carbolate calculated in the mass. The dry carbolate is then either put into the retorts at once, or it may be kept for further treatment by putting it, while hot, into vessels which may be hermetically sealed. The fact that sodic carbolate is very hygroscopic explains the necessity of this manipulation.

After the carbolate is put into the retorts, the contents are slowly heated to 212° Fah., and when this temperature is reached, a slow current of perfectly dry carbonic acid gas is allowed to enter the retort. The temperature is then slowly increased to 356° Fah., and may, towards the end of the operation, reach to 428° or 482° Fah. About an hour after the beginning of the operation, carbolic acid will begin to distill, and the process may be considered finished, if, at the latter mentioned temperature, no more carbolic acid distills. It will be found that the distilled carbolic acid amounts to just one half of the original quantity employed. The residue in the retort is basic salicylate of soda, which is dissolved, and which, on acidifying with an acid, yields a brownish-colored crystalline precipitate of salicylic acid.

With regard to the purifying of the crude acid as obtained by the process given above, Rautert's method is usually employed; it is as follows: The crude acid is placed in a retort and strongly heated to 338° Fah., when a current of steam at a like temperature is injected into the retort. In the presence of the superheated steam, the acid distills at once; and after a short time, nothing remains in the retort but a trace of a black resinous mass. The apparatus must be arranged in such a manner that the neck of the retort may be kept free from crystals, as, for instance, by an inserted movable wire.

The Literature of Manganese.

Dr. H. C. Bolton of this city has been ransacking the literature of the past and present to learn what has been said and written about manganese, its ores and its compounds. In a communication to the Lyceum of Natural History, in November last, he detailed all the sources of information on this subject. The results of his patient labors have recently been published in the *Annals* of that society, and also reprinted in pamphlet form under the title of "Index to the Literature of Manganese." In this little pamphlet of 44 pages are contained 400 distinct references to manganese minerals, extending from 1596 down to 1873, and 1,700 references to chemical papers beginning with Pott's "*Examen chymicum magnesia vitriariorum, Germanis Braunstein*," published in Berlin, in 1740. The value of an index of this kind, to a person wishing to examine the literature of or study any of the compounds of manganese, can scarcely be over-estimated. The references are arranged in chronological order, and give the name of the investigator, subject of the paper, and list of all the journals into which it has been copied with number of volume and page.

Nor is this the first work of the sort done by this chemical antiquarian. In 1870, Dr. Bolton published a similar index to the literature of uranium, from its discovery by Klaproth in 1789 to 1869.

We hope that other chemists, who have prepared extensive lists of reference on subjects that they were investigating, will be induced to put them in print for the benefit of others that may come after, in a style uniform with those above described.

Electrical Dust Figures in Space.

A brass rod pointed at one end, and with a ball at the other, is laid horizontally on an ebonite plate supported on wood; receives sparks from an electric machine; is discharged by touching, and removed; and the plate is then sprinkled with a fine powder. The author gives drawings of the negative and positive figures obtained. Conceive these turned about their axes, and we have the electrical dust figures in space, of which the ordinary Lichtenberg figures are merely sections.

M. Lommel fixed the brass rod in a certain position, and moved the ebonite plate up and down under it, taking figures at each position. He also used an ebonite plate with an aperture, allowing the brass rod to pass through it. He shows how the various figures are related to the original two. The cause of the Lichtenberg figures is to be found (he thinks) in a peculiar state of motion of the air about the conducting body, and this is simply imaged on the ebonite plate.

TURBINE WATER WHEELS.

BY S. W. ROBINSON.

A look at the numerous turbines on exhibition in Machinery Hall, and their elaborate catalogues, giving lists of the thousands which have been introduced in this country, gives evidence of a thriving and extensive business; and one can hardly realize that thirty years ago the turbine was scarcely recognized as a motor.

The first wheel of this kind was made in France by a Frenchman named Burdin, in 1837 or 1838, but the real merits of the wheel were not generally accepted till some five years after. Soon after this it began to receive the attention of American engineers; and the first of these wheels of importance was constructed by Uriah A. Boyden, in 1844, and introduced into the Appleton Company's cotton mills at Lowell, Mass. Tests of these wheels gave remarkable results, the maximum being 92, and the mean maximum 88, per cent of useful effect from the power of the water.

This extraordinary figure is supposed to be due to the engineer's extreme precaution in polishing the surfaces of the apparatus, using Russian iron guides and floats, and in giving such form to the flume as to impart to the water, as it approached the guides, such a spiral-like rotation as to cause it to enter the guides without resistance. The trials which gave the above percentages decided the great superiority of the turbine over the old breast wheel, and engineers at once saw that, for perfecting water motors, their attention must be turned into a new channel.

The breast wheel was at once summarily dismissed, and the turbine adopted for reasons unmistakably in its favor, some of which are the following: 1. Increase of percentage from five to fifteen. 2. Greater compactness. 3. Perfect freedom from back-water annoyance. 4. Perfect adaptation of given wheel to all heads. 5. More convenient speed of running. 6. Much less subject to fluctuations of speed. 7. Convenience of installment, and for shipment ready made. Advantages of breast wheel, none.

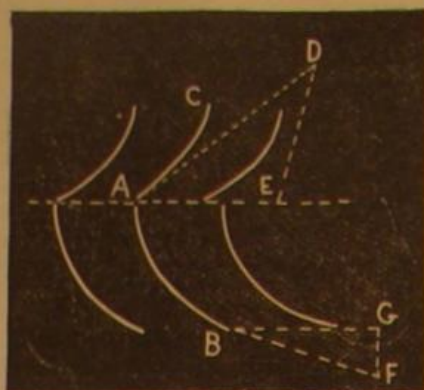
Some of these points are self-evident, but others, such as Nos. 1, 3, 4, and 6, may not be. To help this, and also for the reason that the correct theory of the turbine wheel is but poorly comprehended, as evinced by the forms given the parts in existing ones, the following descriptive exposition of the main theory is given with the hope that practical builders may thereby receive a benefit.

First of all, water wheels must receive power from the water by reducing its velocity, and water engines by action of its pressure. These points are believed to be sufficiently evident from observation. It is therefore obvious that, for a maximum of effect, the water should have the greatest possible velocity due to head in approaching the wheel; and in leaving, the motion should be entirely destroyed. To illustrate, suppose a flat disk be placed square against an isolated jet of water. If stationary, the water will be thrown in all directions without much change in velocity, and no power is developed because standing still. If it moves with the water the stream is not disturbed, and also no power developed. At half the water velocity, the vane receives its greatest power, but the water is projected laterally, and for this reason the motion of water is not destroyed, and the maximum of effect is known by hydraulic engineers to be only half the power stored in the moving jet. But this is what may be styled a fair example of percussion, and hence builders of wheels who operate on this principle must expect low returns.

Next, suppose the vane be in the form of a hollow half cylinder, and placed so that the jet strikes it tangentially at one side. While stationary, the water is sent around the smooth surface, and escapes, with velocity unchanged, in a direction differing by 180°; and of course we have no power. Giving the vane the velocity of the jet, we get no power again, but with half the velocity of the stream it receives the water with a relative velocity, one half its absolute, and passes it to issue at 180° unchanged, at which the absolute velocity of the water is zero. Now multiplying the motion of vane by the pressure against it, the result is found to be equal to the whole power of the water. In this example we see that the water is delivered upon the float without shock or percussion, and leaves it without velocity, which principle has long been known in theory as the necessary condition for high percentages. As this has regard to the power of the jet only, the latter should, of course, be made the maximum, by giving the water the highest possible velocity of projection. Of the forms of orifice of projection, the one known, from experiment, to give the greatest velocity is that formed in a thin wall, whose coefficient, or realizable percentage of the theoretic velocity, is about 97. Rapidly converging adjutages give very nearly this, say upwards of 92, while prismatic adjutages give only 82 per cent. Hence a turbine, whose chutes have parallel sides, can only return a percentage of 82, provided the wheel otherwise be absolutely perfect. It is therefore evident that the form of chute is of no whit less importance than the wheel.

Again, in turbines there should be a certain adaptation of chutes and floats to each other, and certain forms of wheel passages and exits. The forms most consistent with theory

are best explained by aid of the accompanying diagram, which may be regarded as a side view of a Jonval turbine. Let A B represent a float of the wheel, and A C a guide. Let D A represent the direction and velocity of the affluent wa-



ter, and B F the same for the issuing water. Take A E or B G for the velocity of wheel, which must be equal, from the nature of the case. The point, D, should be found by making D E equal to A E, and the direction of D E the same as the first elements of the floats. Then we have $DE = AE = BG$.

Now if a particle of water moves from D to A, while a point on the wheel moves from E to A, the direction and velocity of the water, relatively to the wheel, will be D E, and hence will enter tangentially upon the float with entire freedom from shock. Compared with the cylindrical vane above, the water will move along the curved float, A B, without change of velocity, and issue with a velocity, B F, equal to D E. But as $DE = BG$, then $BG = BF$, and the absolute velocity of the water will only be G F. If the water could be made to issue tangentially, G F would be zero, as required for a percentage of 100. Though in practice G F must have a magnitude, it should be reduced to the minimum. The water has also been regarded as having uniform velocity from A to B. That this be possible, the transverse sections through the inter-float passages should be the same at all points. Hence, that the exits be thin, requires them to be long from crown to crown. And again, in order to deliver the water on wheel in direction, D A, the last elements of the guides should have the direction, D A; otherwise the form should be favorable for high velocity of projection.

Now this diagram may be greatly varied, and still these principles hold equally well. It is only necessary that $DE = AE = BG = BF$; last element of guide have direction D A; first element of float have direction D E; and inter-float passages be uniformly large from beginning to exit. The velocity of wheel will be to that of the water as A E is to A D. When the first elements of float, for instance, are perpendicular to A E, the guide direction, A D, should be 45°. For float direction, A D, 60° to the right, guide direction will be 60° to the left, and A D E will be an equilateral triangle. Indeed A D E is always an isosceles triangle.

In designing a wheel it is very important that there be no interference to free passage of water in the curbing or penstock, or in the vent from wheel; and hence these should be large and unobstructed.—Polytechnic Review.

THE BLACK KNOT.

There are many things in Nature seemingly so insignificant that we consider them unworthy of our notice; yet they have the power of doing us great benefit or harm according to their habit. The mold, upon bread, cheese, and on most other neglected vegetable matter, is well known to be a plant growth of a low order. It is a fungus, and of the same nature as our common mushrooms. The potato disease, which is causing so much anxiety in England and on the continent of Europe, is also the result of a fungous growth. These plants are now receiving considerable study from botanists on account of both their practical and their scientific interest.

In this country, and peculiar to it, the black knot, as it is called, on plum and cherry trees has recently been proven to be another fungus. Dr. W. S. Farlow, of Harvard University, has presented, in the *Bulletin of the Bussey Institution*, a most important paper as the result of his researches on this subject. The black, warty excrescences on plum trees and on all kinds of wild and cultivated cherries have been noticed by every one from early time, and have long been the bane of fruit growers. For the most part, these have been attributed to the work of insects; and this has not been without considerable shadow of reason. Insects are not unfrequently found there, and in old knots insects or their remains are generally found. The curculio often pierces the knot in its young state, and deposits within it its eggs, which soon hatch out. The young live in the knot, and may be found there in the various stages of their development. Insects also of different species have been found within these knots.

But it is now conclusively demonstrated that the unsightly knots are not of insect origin. Though, till very recently, the subject has been almost entirely neglected by botanists, it now seems certain that they have determined its true character. The knots are not like galls, made by a known insect; and when young, they are most frequently entirely devoid of insects. Again, the fact that the insects are not all of one species, and the very same are also found on trees which are never afflicted with knot, would be quite conclusive against this assumption. On the other hand, the knot has never been found without the presence of the specific

fungus (*sphaeria morbosus*), which is now accepted as its origin; and this fungus is not known to exist except in connection with the knot. The mycelial threads, however, of the fungus are found in the slightly swollen stem long before any real semblance to a knot has appeared; but the growth of these may be traced till the knot has attained its full size, and the fungus has shown all its phases of life.

Dr. Farlow has considered the life history of the fungus, whether the disease is the same on plum and cherry trees, and the means of preventing its ravages.

The knots vary in size from a few lines to several inches in length, and average about two inches in circumference. They seldom entirely surround the branch, and often cause it to bend or twist into unsightly shapes. The vegetative portion first appears in the form of very minute threads (mycelium), twisted together and extending from the cambium—or inner—layer of the bark towards the outer portion of the stem. "The fungus first reaches the cambium either by the germination of spores on the surface of the branch, or by the mycelium proceeding from a neighboring knot." Hence the Professor concludes that the growing layer of tissue is where the fungus commences its work of destruction. During the growing stages of the knot—which continue to the flowering time of its victim—it is of a greenish color and solid or pulpy throughout. When it has attained its maturity, it turns black; and in the winter it often becomes cracked, broken, worm-eaten, and hollow. The outer shell contains the perithecia, which are small pits or sacs containing the sexual spores. These, always eight in number, are borne in asci or cells. These cells grow slowly during the winter, and the spores in them ripen from the middle of January to the end of February. Those ripening in February germinate in from three to five days, if sufficiently moist.

Microscopic investigation proves that the knots on plums of all sorts, and on cultivated, wild, and choke cherries, are identical; though, to the naked eye, they differ slightly in general appearance, owing probably to the more favorable circumstances for their growth in some species of the genus *prunus* than in others.

The remedy against this contagious disease is a very obvious one: simply to cut off and burn the knots and swollen branches when and wherever found. This should be done in autumn as soon as they become plainly seen by the falling of the leaves. It is not sufficient to cut them off, for some of the spores which do not ripen till late in the winter have been carefully observed to ripen after the branches were cut from the tree and not afterwards burnt. Professor Farlow recommends the complete destruction of choke cherry, bird cherry, and wild plum trees, since they furnish means for the rapid propagation of the knot, and are themselves of little value in comparison with the cultivated cherries and plums. "Concert of action is what is needed in this matter, and not only by attending to one's cultivated trees, but to the wild plums and cherries that frequent our fence rows and woodlands as well: as in very many instances the latter prove to be pest houses where the contagion is propagated and sent forth to carry desolation over many a thriving tree, dear to the eye of its owner." The wild plums are the most abundant in the Western States, and the wild and choke cherries in the Eastern. These, in their habitats therefore, require special attention.

This is a matter of vast importance to fruit growers; and to institute vigorous measures, against this destructive fungus, will be a great source of profit to fruit producers and merchants, as well as an equally great source of comfort and enjoyment to the consumer. S. H. T.

The American Reports on the Vienna Exposition.

We have received the four volumes of reports of the United States Commissioners to the Vienna Exhibition of 1873, which have just been published, under authority of Congress, at the Government Printing Office, at Washington, D. C. The work possesses a double interest: first, in that it is a tangible result of the expenditure of \$200,000 of the people's money, and of the labors of certain paid scientific commissioners and eight practical artisans; second, in that it is a valuable record of the Vienna show, edited with much ability and discriminating judgment.

Professor Thurston devotes volume first to an introductory description of previous world's fairs, following which is a complete account of the organization of the Vienna Exposition. Copious extracts from the reports of the commissioners from other nations upon the United States exhibit are given; and a report on forests and forestry, by J. A. Warder, M. D., and one on sheep and wool, by J. R. Dodge, close the volume. In volume second are collected all the reports on scientific and educational subjects. Volume third is mainly occupied by the editor's own report on machinery and manufactures, to which are added Mr. William Watson's paper on "Engineering and Architecture," that of Mr. Fairfield on "Sewing Machines," and that of Mr. Charles Davis on "Hydraulic Engineering." Volume fourth contains reports on buildings, wood and stone industries, metallurgy, and a copious general index, which greatly adds to the value of the work as a book of reference. There is a lavish profusion of maps and engravings, and the general appearance of the book is superior to the usual official productions of the government printer. We shall, as opportunity offers, lay before our readers such abstracts from the work as appear interesting. Meanwhile, and in advance of the public verdict, we can warmly commend Professor Thurston's labors. He has accomplished a task of great magnitude, with a thoroughness which will secure wide and favorable recognition, and he has given us probably the best set of reports ever based upon a world's fair.

Science in America.

The following passage taken from the opening address of Professor Sir William Thomson, on assuming the chair of the section of physical science at the Glasgow meeting of the British Association, will be read with interest as showing the impression made upon an English student of Science by our progress in discovery and practical science:

"Six weeks ago, when I landed in England after a most interesting trip to America and back, and I became painfully conscious that I must have the honor to address you here to-day, I wished to write an address, of which Science in America should be the subject. I came home indeed vividly impressed with much that I had seen, both in the great exhibition at Philadelphia and out of it, showing the truest scientific spirit and devotion and originality, the inventiveness, the patient, persevering thoughtfulness of work, the appreciativeness, and the generous open-mindedness and sympathy from which the great things of Science come.

"I wish I could speak to you of the veteran Henry, generous rival of Faraday in electromagnetic discovery; of Peirce, the founder of high mathematics in America; of Bache, and of the splendid heritage he has left to America and to the world, in the United States coast survey; of the great school of astronomers which followed—Newton, Newcomb, Watson, Young, Alvan Clarke, Rutherford, Draper, father and son; of Commander Belknap, and his great exploration of the Pacific depths by pianoforte wire, with imperfect apparatus supplied from Glasgow, out of which he forced a success in his own way; and of Captain Sigsbee, who followed with the like fervor and resolution, and made further improvements in the apparatus, by which he has done marvels of easy, quick, and sure deep sea soundings in his little surveying ship Blake; and of the admirable official spirit which makes such men and such doings possible in the United States naval service.

"I would like to tell you, too, of my reasons for confidently expecting that American hydrography will soon supply the data from tidal observations, long ago asked of our government in vain by a committee of the British Association, by which the amount of the earth's elastic yielding to the distorting influence of sun and moon will be measured; and of my strong hope that the compass department of the American navy will repay the debt to France, England, and Germany, so appreciatively acknowledged in their reprint of the works of Poisson, Airy, Archibald Smith, Evans, and the Liverpool compass committee, by giving in return a fresh marine survey of terrestrial magnetism to supply the navigator with data for correcting his compass without sight of sun or stars. I should also tell you of 'Old Prob.'s' weather warnings, which cost the nation \$250,000 a year, money well spent, say the western farmers, and not they alone; in this the whole people of the United States are agreed, and though Democrats or Republicans playing the 'economical ticket' may, for half a session, stop the appropriations for even the United States coast survey, no one would for a moment think of starving 'Old Prob.'; and now that 80 per cent of his probabilities have proved true, and General Myer has, for a month back, ceased to call his daily forecasts probabilities, and has begun to call them indications, what will the western farmers call him this time next year? The United States naval observatory is full of the very highest Science, under the command of Admiral Davis.

If, to get on to precession and nutation, I had resolved to omit telling you that I had there, in an instrument for measuring photographs of the transit of Venus shown me by Professor Harkness (a young Scotchman attracted into the United States naval service), seen, for the first time in an astronomical instrument, a geometrical slide, the verdict on the disaster on board the Thunderer, published while I am writing this address, forbids me to keep any such resolution, and compels me to put the question: Is there in the British navy, or in a British steamer, or in a British land boiler, another safety valve so constructed that, by any possibility, at any temperature, or under any stress, it can jam? and to say that if there is, it must be instantly corrected or removed. Can I go on to precession and nutation without a word of what I saw in the great Exhibition of Philadelphia? In the United States government part of it, Professor Hilgard showed me the measuring rods of the United States coast survey, with their beautiful mechanical appliances for end measurement, by which the three great base lines of Maine, Long Island, and Georgia were measured with about the same accuracy as the most accurate scientific measures, whether of Europe or America, have attained in comparing two meter or yard measures. In the United States telegraphic department I saw and heard Elisha Gray's splendidly worked-out electric telephone, actually sounding four messages simultaneously on the Morse code, and clearly capable of doing yet four times as many with very moderate improvements of detail; and I saw Edison's automatic telegraph delivering 1,015 words in 57 seconds—this done by the long-neglected electro-chemical method of Bain, long ago condemned in England to the helot work of recording from a relay, and then turned adrift as needlessly delicate for that.

"In the Canadian department I heard 'To be or not to be'—'there's the rub,' through an electric telegraph wire; but, scorning monosyllables, the electric articulation rose to higher flights, and gave me passages taken at random from the New York newspapers: 'S. S. Cox has arrived' (I failed to make out the S. S. Cox), 'The city of New York,' 'Senator Morton,' 'The senate has resolved to print a thousand extra copies,' 'The Americans in London have resolved to celebrate the coming Fourth of July.' All this my own ears heard spoken to me with unmistakable distinctness by the thin, circular disk armature of just such another little electromagnet as this which I hold in my

hand. The words were shouted with a clear and loud voice by my colleague Judge, Professor Watson, at the far end of the line, holding his mouth close to a stretched membrane, such as you see before you here, carrying a little piece of soft iron, which was thus made to perform in the neighborhood of an electromagnet in circuit with the line motions proportional to the sonorous motions of the air. This, the greatest by far of all the marvels of the electric telegraph, is due to a young countryman of our own, Mr. Graham Bell, of Edinburgh and Montreal and Boston, now becoming a naturalized citizen of the United States. Who can but admire the hardihood of invention which devised such very slight means to realize the mathematical conception that, if electricity is to convey all the delicacies of quality which distinguish articulate speech, the strength of its current must vary continuously, and, as nearly as may be, in simple proportion to the velocity of a particle of air engaged in constituting the sound?

"The Patent Museum of Washington, an institution of which the nation is justly proud, and the beneficent working of the United States patent laws deserve notice in the section of the British Association concerned with branches of Science to which nine tenths of all the useful patents of the world owe their foundations. I was much struck with the prevalence of patented inventions in the Exhibition; it seemed to me that every good thing deserving a patent was patented. I asked one inventor, of a very good invention: 'Why don't you patent it in England?' He answered: 'The conditions of England are too onerous.' We certainly are far behind America's wisdom in this respect. If Europe does not amend its laws (England in the opposite direction to that proposed in the bills before the last two sessions of Parliament), America will speedily become the nursery of useful inventions for the world. I ought to speak to you too of the already venerable Harvard University, and of the Technological Institute of Boston, created by William Rogers, brother of my Glasgow University colleague, Henry Rogers, the Cambridge of America, and of the Johns Hopkins University of Baltimore, which with its youthful vigor has torn Sylvester from us, has utilized the genius and working power of Roland for experimental research, and, three days after my arrival in America, sent for the young Porter Poinier to make him a Fellow. But he was on his death bed in New York, 'begging his physicians to keep him alive just long enough to finish his book, and then he would be willing to go.' Of his book, 'Thermodynamics,' we may hope to see at least a part, as much of the manuscript and kind and able friends to edit it are left; but the appointment of a fellowship in the Johns Hopkins University came a day too late to gratify his noble ambition. But the stimulus of intercourse with American scientific men left no place in my mind for framing or attempting to frame a report on American Science."

THE LATEST NEWS FROM THE SUN.

There are not many persons living who, with the reverend Director of the Observatory of the Roman College, can lay claim to have minutely examined the face of the sun every day for the past ten years. Father Secchi, moreover, as an astronomer is the peer of Lockyer, Huggins, or Young, and as such his conclusions are worthy of the highest respect. The new edition of his work on the sun, which has lately been published in Paris, embodies the results of his most recent investigations, as well as of those which have extended over long periods of time, and hence it may be regarded as one of the latest dicta of Science regarding the physical constitution of our luminary.

Father Secchi's theory of the sun spots is that they are phenomena of eruption. They result from the upheavals which take place in the solar mass, and form, in the photosphere or luminous envelope, cavities more or less regular, surrounded by brilliant projecting ridges. The depth of these cavities rarely exceeds 3,600 miles—generally it is less—and the hollows themselves are filled with dark vapors which absorb and so cut off the luminous rays emitted by the strata beneath. The physical constitution of the solar mass, and the true nature of the incessant motion of which it is the seat, have been little understood. Now, however, we are in possession of a spectroscopic method of distinguishing the different currents which cross and mingle, of discerning the jets of hydrogen and of incandescent metallic vapors, and observing the rose-colored protuberances which formerly could not be studied, except during a total eclipse, when the bright light of the radiant disk was intercepted. Father Secchi has determined the closest relations between the spots and the protuberances seen on the solar edge.

If the results of a series of observations of solar rotations be considered, it appears that the spots, the most brilliant facule, and the eruptive protuberances (those which contain metallic vapors) appear as a rule in similar regions on the solar disk, that is to say, in the two zones near the equator and comprised between the 10th and 30th parallels of latitude, and that the majority of these phenomena occur at the same epochs. When a number of individual observations of spots and protuberances are thus compared, this conclusion is often at fault; but this is to be expected, because the protuberances can be seen only on the edge, while the spots and facule are visible on the face, of the sun. On the other hand, the parallelism of the three orders of phenomena becomes manifest when the results are considered in the aggregate. Moreover, whenever a considerable protuberance rises on the oriental side, it is almost certain that a spot will appear next day in the same place.

Father Secchi therefore considers that without doubt the spots and protuberances are correlated phenomena, and that the spots are a secondary effect of the eruptions which are

revealed to us by the protuberances. It is necessary, however, to note that the latter do not always appear to be true eruptions, as they are often simple jets of incandescent hydrogen which rise from the photosphere like fires from a forge. Such flames cannot produce the absorbent vapors which form the spots. Hence a distinction must be made between eruptive protuberances characterized by the presence of metallic vapors, and hydrogen protuberances where such vapors are not manifest; but, the author adds, traces of the metallic spectroscopic lines are almost always discernible at the base of the hydrogen jets. The difference between the two kinds of protuberances, therefore, while existing, is not clearly defined. Often the metallic lines of the protuberances are visible on the solar disk, and are prolonged as far as the nucleus of a spot near the edge, affording irrefutable evidence that the metallic vapors have their origin near the nucleus. Beyond the 40° parallels, true spots and eruptions are rarely encountered.

The eruptions are probably violent crises produced by chemical combinations which occur at a certain depth below the solar surface. The cooled products of the reactions unite in thick clouds, like those clouds arising from sulphur volcanoes, which fall by virtue of their weight when condensed, and bury themselves in the luminous envelope, while they in turn are quickly invaded by the ambient matter of the photosphere. From all sides tongues of fire penetrate the interior of the spot, and, joining it together in places, divide it into segments. These luminous filaments give to the penumbra its radial structure, and then, becoming as it were dissolved in the obscure mass, lose their brilliancy by cooling. The spot then assumes quite a regular rounded form; a period of calm succeeds the fierce effervescence and the tumultuous and discordant movements which characterize the formative processes. Above the dark nucleus, less intense emanations occur of short and slightly luminous flames, in which the spectroscopic is no longer able to recognize the lines of metals. Then, little by little, the spot diminishes and finally totally disappears.

This theory is believed to account for all the phenomena hitherto observed; and it will be seen that Father Secchi is no adherent of the whirlwind theory, which he somewhat brusquely dismisses as a "fiction destitute of all reality." Out of several hundred spots which he has closely observed he says that but seven or eight show a spiriform structure. This even disappears in a day or two, and often the rotary movement, after becoming slower, is rendered in the opposite direction. The motion, he affirms, is no essential property of the spots.

The physical constitution of the sun, our author sums up as follows: The sun is formed of a fluid incandescent mass, enveloped in a highly luminous photosphere, above which there is yet an atmosphere of less density. The photosphere is a fiery mist, probably of gases which have become luminous through the effect of high temperature and high pressure. Immediately above this, a very thin envelope of metallic vapors mixed with those of hydrogen is encountered. This is the chromosphere, and its thickness is from 10 to 15 seconds of arc. Beyond the chromosphere again there is a vast envelope composed of hydrogen and of two unknown substances which produce the yellow spectrum line D₂, and the line 1,474, and to one of which the name "helium" has provisionally been given. During total eclipses of the sun, the outer envelope becomes visible and produces the phenomenon of the corona. Finally the vast eruptions throw forth jets of hydrogen to heights equal to one fourth the solar diameter, 224,400 miles, and with such tremendous velocity that it is believed that the hydrogen may at times leave the sun and pass into the interstellar space.

Look Out for Him.

A correspondent from Springfield, Mo., sends us a receipt signed R. Allen, for one year's subscription to the SCIENTIFIC AMERICAN.

The writer states that the person to whom he paid his \$3.20 was a modest, retiring sort of an individual, and represented himself to be a special correspondent of the paper. It is likely that the same party has swindled others out of their money, in Springfield and other places in the vicinity.

We warn our friends in all parts of the country against subscribing and paying money to any one unknown to them, on our account. No traveling agents are employed; and if any stranger claims to be an authorized agent for soliciting subscriptions, denounce him as a swindler wherever you find him, and keep your hand on your pocket so long as the person remains.

Naval Engineer Corps Gazette.

September 29. Chief Engineer John B. Carpenter and Assistant Engineer C. P. Howell were detached from the United States steamship Alaska, and placed on waiting orders. Passed Assistant Engineer Julien S. Ogden has been ordered to duty at the Navy Yard, New York.

October 4. Chief Engineer O. H. Lackey was ordered to duty as member of the board at Annapolis, Md., for the examination of midshipmen for promotion to the grade of ensign.

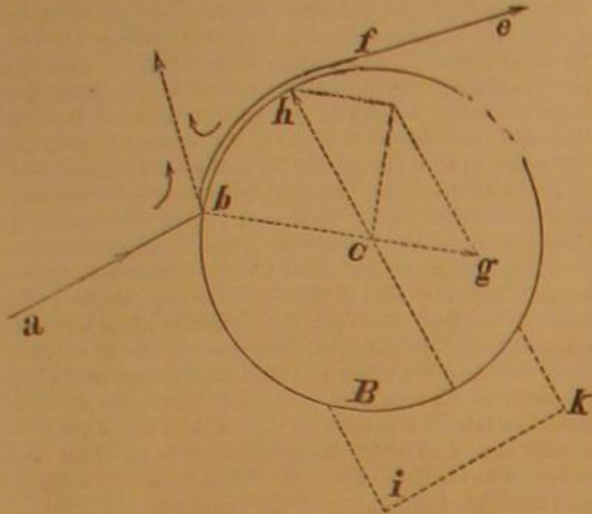
Passed Assistant Engineer Robert Crawford has been ordered to temporary duty at the Naval Academy, Annapolis, as an instructor in the department of steam engineering.

For the protection of workmen handling lead and mercury compounds, M. Melsens, of Paris, France, recommends small daily doses of iodide of potassium. This salt, he says, dissolves the lead or mercurial compounds, and effects their removal.

A THEORY OF THE BALL PUZZLE.

Mr. Hugo Bilgram, of Philadelphia, has written the following explanation of the ball puzzle described in the SCIENTIFIC AMERICAN SUPPLEMENT, page 576, volume II.:

A current of air, $a b$, striking the ball, B , will not, as might be expected, be reflected in the line from b , nearly at right angles to $a b$, but will follow the course, $b f e$. The reason can be explained as follows: Any current of air has a tendency to carry along with itself the surrounding air; but the current, $b d$, can be supplied from one side only, while on the other side, in the angle, $d b f$, a rarefaction of air takes place. The current will therefore be deflected by the pressure of the atmosphere, and take the course as shown. The impact of the air, at b , produces the force, $c g$, while the surplus pressure of the column of air, $i k$, over the rarefied conditions under the current, $b f$, exerts the pressure, $c h$. These two forces united produce a vertical force equal to the weight of the ball. The rarefaction of



air, between b and f , as well as the deflection of the current, can easily be demonstrated by experiment.

Ourselves as Others See Us.

We all like to know what others think of us, even if their opinion makes us wince; and recognizing this fact, a bright newspaper man has been chatting with the representatives of the foreign nations at the Centennial show to learn their notions of our country and ourselves. The phlegmatic Turk is astounded at our inquisitiveness. "They come up to your stand, handle your goods, ask you all sorts of impertinent questions, never apologize for troubling you, but address you invariably with the inevitable 'how much.'" We fear the Turk makes a fair criticism. The Frenchman thinks our mode of life, so far as eating is concerned, is detestable. "Your mode of living," said one of the commissioners, "is the cause of illness among your women, which must affect the whole race. The undue use of ice water, ice cream, iced drinks of all kinds, the abuse of pepper and salt, are all injurious. You need a public school to teach the art of proper feeding." The Belgian also detests our mode of living and our cooking. He thinks our national stomach must be out of order—not far out of the way—and we eat too much meat. While we are exceedingly sociable, we have no *cafés*, and drink too often and too quickly; this is also the Belgian's criticism. The Frenchman, so far as our character is concerned, thinks "the high appreciation of number one does much to stunt the development of morality." The Spaniard declares us to be "the most cordial and hospitable people in the world." The Italian thinks we lack sentiment and principles. "To achieve what you have done," said one of the Italian Commission, "you have had to make a god—the dollar—and a machine of your country, a money-making apparatus." But the American women puzzle the Italian the most. Says this same commissioner:

"I ask myself concerning them: Is it innocence, virtue, ingenuousness, or what? They are the most impertinent creatures I ever saw. They go up to a foreigner with the most perfect *sang froid*, stare him out of countenance, ask him if he is married, how many children he has, where he comes from, and I know not what. Their excessive freedom of manner to our hot-blooded people seems what I hope it is not. But they take the most extraordinary liberties. Fancy a pretty girl of eighteen laying her little dimpled hand on your arm and asking you, naively or boldly, I know not which, how you like the American ladies?—What the deuce can one think?"

Like the Frenchman and Belgian, the Italian is disgusted at our cooking. "You need a thorough reformation of your cuisine," said one. "You have little or no variety of food, and oh! you lack good wines! If you only had our wines, you would have less public drunkenness." The German laments the absence of domestic life; but he seems to regard America as a sort of promised land, and thinks it especially a paradise for working men. The Austrian, like the Turk, is disgusted with the national impoliteness. Said one: "The people are pleasant enough, but they do not know the use of the words 'please' and 'thank you,' and seem to imagine that for the admission price of fifty cents they purchase the services, as guides, instructors, and playthings, of all the exhibitors." And then we are woefully ignorant. "Most of the American visitors here," said the same Austrian, "don't know the difference between Austria and Australia, and ask me how I like living in the bush. One old lady asked me, just now, 'where is the Belgian and Brazilian stands? You know, the place where they make bug jewelry, jewelry out of bugs,' and that is only one instance from many hundreds."

The Dane thinks our middle classes not so well educated as those of his own country. The Mexican is particularly struck by the abuses of our street car travel and our hacks. He would have stringent laws to prevent the overcrowding of the street cars, and, to stop the extortion of the hackmen, capital punishment. The Dutchman doesn't like our women, thinks they are weak and puny, compared with their buxom girls. And the opinion of the Chinaman is compressed into the following expressive sentences: "Much likee Melica. Costee muchee money livee in Melica, costee little money livee Chillee. Chillee man makee muchee money in Melica; Melican man makee d—n little money in Chillee."—*Boston Weekly Globe*.

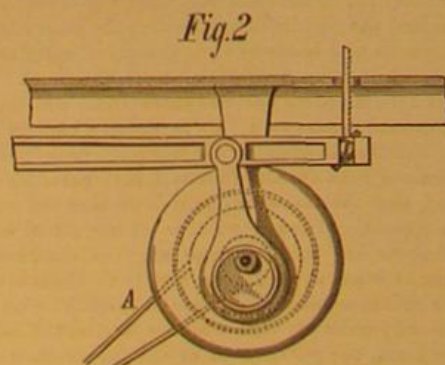
THE "MODEL" SCROLL SAW.

We illustrate herewith a new scroll saw, excellently suited for amateur use. It is capable of cutting wood up to one and a half inches in thickness, of holding blades of all sizes, from one fourth inch down to the finest made, without adjustment, and it works rapidly and smoothly. It offers beside the advantage of not being driven by a crank motion from the treadle, but by devices which have no dead centers, and which therefore maintain the machine in continuous movement. By pressing down the treadle, the strap attached thereto is caused to rotate a noiseless clutch, Fig. 2, by which the balance wheel is driven. The latter, by means of an eccentric, moves the arms to which the saw is attached. The clutch merely touches the balance wheel when driven forward, but becomes entirely disconnected therefrom when it is stopped, so that the wheel is thus left to run free. When the motion of the balance wheel slackens, the treadle, which has been drawn up by the reverse



rotation of the clutch shaft, by the spring arm and strap, A , Fig. 1, into its normal position, is again pressed down and the wheel receives fresh impulse. The saw starts at once in the right direction; and the thinner the material cut, the less frequently is it necessary to work the treadle.

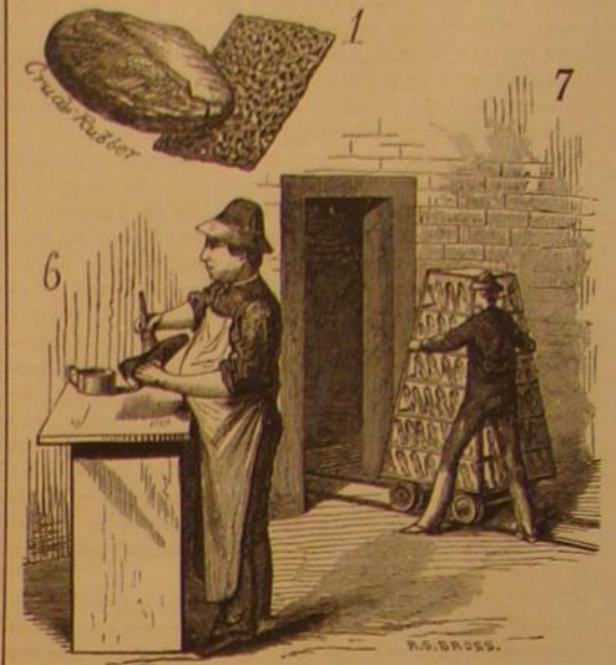
The upper saw arm is jointed at B , so that it can be raised entirely out of the way of the work when changing the blade from one hole to another in sawing inside portions. To hold the saw, the elasticity only of the upper arm is used; and in fastening the upper end of the blade, it is therefore merely necessary to push down the arm until the desired strain is obtained. This of course can be varied to suit the



size of saw and the kind of work. The machine, we are informed, is made in quantities on special apparatus and to standard gages. It is entirely of metal, and has no adjuncts beyond the six saws which are supplied with it. The arm holding the saw works on steel points, and is jointed to the connecting rod by an adjustable bearing which takes up the

wear. The main shaft is of Stubbs' steel. The space under the arm is fifteen inches in the clear, and thus allows of sawing to the center of a piece thirty inches in diameter. The balance wheel is so adjusted that there is scarcely any vibration even when the machine runs at from 1,000 to 1,200 revolutions per minute. The finish is ornamental, and the workmanship is neat and good.

For further information address the manufacturers, Messrs. Bush & Smith, West New Brighton, Staten Island, N. Y.

RUBBER OVERSHOE MAKING AT THE CENTENNIAL. 3
The inventors of the rubber overshoe were the IndiansRAW RUBBER. THE VULCANIZING OVEN.
VARNISHING THE SHOES.

who inhabited those portions of Brazil where the caoutchouc tree most abounded. Their method of manufacture consisted in making a rude last of clay, which was covered repeatedly with layers of the juice, each coating being allowed to dry before the next was applied. When a proper thickness was attained, the mold, with its elastic covering, was held over the smoke of a wood fire for a time, and the clay was then broken out. It was not until 1825 that the rubber shoe made its appearance in the United States; and then Thomas C. Wales, a Boston merchant, imported a few of the crude Indian productions from Brazil. Rough and ungainly as these feet coverings were, their superiority over goshaws, which were nothing more than wooden shoes or clogs, and which furnished the only means, beyond extra thick leather boots, of protecting the feet during wet weather, was soon perceived. Mr. Wales thereupon sent to Brazil a large number of American lasts of better shape than those used by the native makers; and such a trade in the shoes speedily arose that, at the end of three years, no less than half a million pairs were exported from Brazil to Europe and America.

Several years before this time both English and American inventors had been seeking for means of utilizing the caoutchouc gum. In 1797, one Johnson obtained a patent in England for waterproofing cloth by covering it with rubber in solution. Hummel, of Philadelphia, followed in 1819, with a gum elastic varnish. Then Macintosh, in England, made in the same year waterproof garments which still bear his name. These efforts were, of course, known in the United States; and the rubber overshoe had no sooner become almost an article of necessity when the results of the cogitations of American inventors over the subject began to appear, in the shape of attempts to make the shoes cheaply by the processes already understood. In 1832 Wait Webster, of New York, patented a process for attaching soles to gum elastic shoes; in the following year the first American factory for the making of rubber shoes, hose, etc., was established in Roxbury, Mass.; but the mode of manufacture in those days differed greatly from that now in vogue, a fact proved by an exhibition of leather boots at the Fair of the American Institute of 1833, which had previously been sent by J. M. Hood, of New York, to South America, to be varnished with the fresh juice from the tree. The Roxbury factory created a wonderful impetus in the trade, shares of its stock sold for many times their original value, and at once six more companies embarked in the manufacture. In 1835 Charles Goodyear invented his nitric acid process for depriving rubber of its adhesiveness, and this was at once applied to the fabrication of the shoe, effectually supplanting other modes of production. It was itself, in turn, supplanted by Goodyear's great invention of the vulcanizing process; and this last, although it has been greatly modified since its origination, is now employed. Such is the briefly told history of the rubber overshoe, an article of apparel now almost indispensable, and one that is manufactured in this country at the rate of some six million pairs per year.

It was an excellent idea on the part of the National Rubber Company, of Providence, R. I., to exhibit not merely their goods at the Centennial Exposition, but also to transport thither a set of machinery, and to show to the visitor the manner in which rubber shoes are made. The annexed engravings represent the different operations, now in progress in Machinery Hall, by means of which the rough lumps of crude rubber are converted into the handsomely finished shoe. A mass of raw rubber is represented in Fig. 1. This, cut

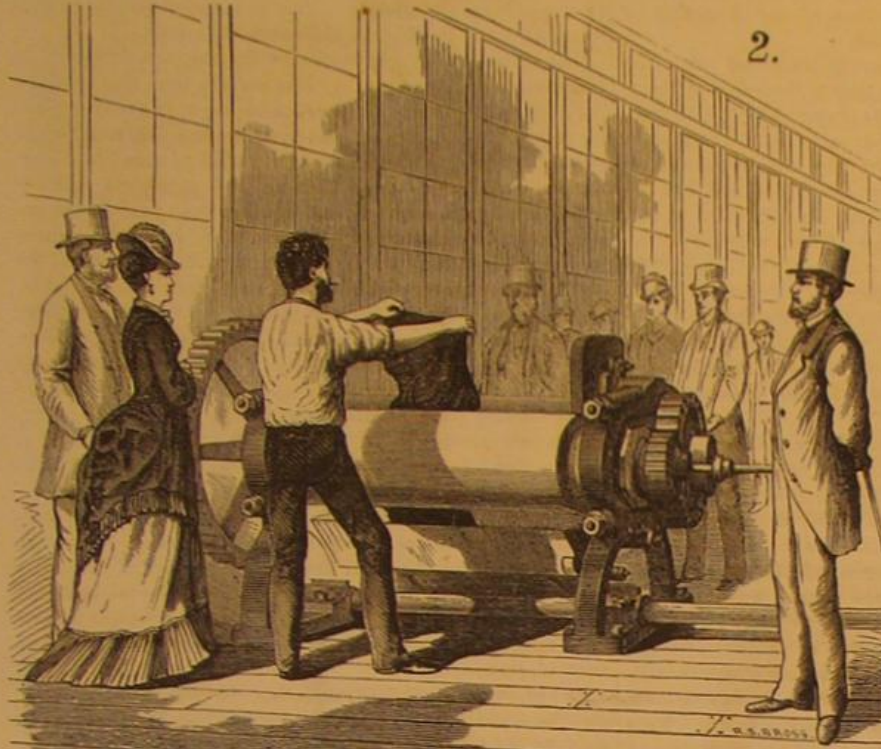
into suitable pieces by hand knives almost as large as swords, is thrown between a pair of fluted cylinders, Fig. 2, between which it is masticated and washed by streams of hot water, emerging in the mat-like form also represented in Fig. 1. Next follows grinding, for from fifteen to twenty minutes, between hot, smooth cylinders; and while the rubber is undergoing this process, the sulphur, tar, and other compounds to be mixed with it are added. The material now begins to form itself into a sheet; and after going through a pair of cylinders which stamp upon it the patterns of the shapes in which it is to be cut, besides ornamentation, etc., it is led to a reel, as shown in Fig. 3. Meanwhile the black cloth, which is to form the backing, is led to the same reel, and as the latter is turned, alternate layers of rubber and cloth become wound about it. It remains now to consolidate the two materials, and this is done by passing the double sheet through heavy calender rollers under great pressure. From the sheets, thus prepared and of varying

remain to the end. In Fig. 7, in rear of the varnisher, a pyramidal iron carriage is shown, which a workman appears to be pushing into an open doorway. Across the framework of this carriage are tiers of bars, and on these bars are fastened the lasts with the varnished shoes upon them. When the carriage is filled it is pushed into the vulcanizing oven, a small brick chamber beneath which are large coils of steam pipes. The steam heat is gradually brought to about 270° Fah., causing, in about seven hours, the complete vulcanization or union of the rubber with the sulphur and other ingredients, and leaving the shoes in fit condition for wear.

Mr. James Lick.

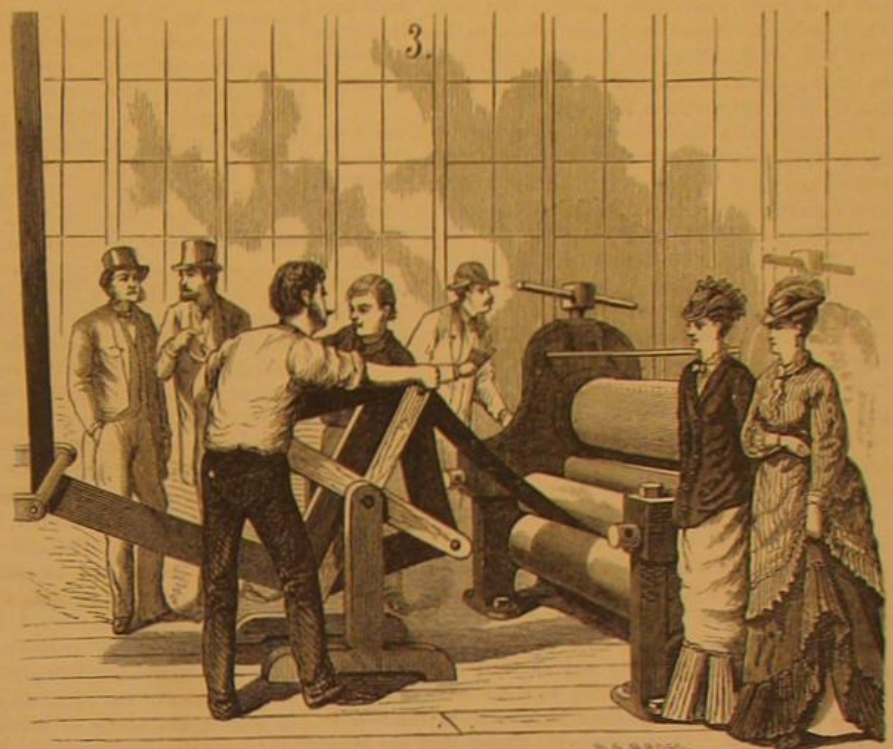
M. James Lick, the California millionaire, through whose munificence the construction of the million dollar telescope was some time ago provided for, died in San Francisco a few days ago. Mr. Lick was born in Fredericksburg, Pa.,

The correct rule for laying shingles of any length, in order to form a roof leak-tight, is to lay the courses less than one third the length of the shortest shingles. For example, when shingles are 18 inches long, many of them will not be more than 17 inches in length. Therefore five inches is all that the courses will bear to be laid to the weather with surety of forming a good roof. The shingles must be three thicknesses over the entire roof. If they are not three thicknesses—if now and then a shingle lacks a quarter or half an inch of being long enough to make three thicknesses—there will in all probability be a leaky place in the roof at such a point. Moreover, when the lower courses lack half an inch of extending up far enough to receive the rain from the outermost course, in case the middle course were removed, it would be just as well to lay them seven or eight inches to the weather as to lay them only five, or five and a half, inches. Many shingles are only 16 inches long, and many that are sold for 16 inches long will hardly meas-



CRUSHING AND WASHING THE RUBBER.

thickness, according to the parts which they are destined to form, the various portions of the shoe are cut (Fig. 4), the workman following the stamped pattern with his curved knife. There are nine portions which go to make up the anatomy of the overshoe: the lining, the filling sole, the outsole, the insole, the forming strip up the heel, the strip around the shoe, the heel piece, the heel stuffing piece, and the junior or auxiliary heel piece; the respective uses of all these are sufficiently indicated by their names. As fast as they are cut out, they are passed to girls who sit beside a high table, perched on elevated stools. Running midway of the table are iron racks, and on pins thereon rest the lasts upon which the shoes are formed. The operation of

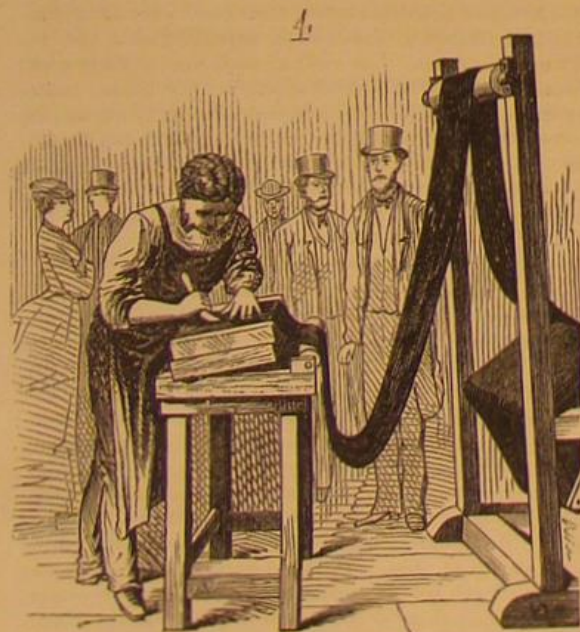


MAKING THE RUBBER INTO SHEETS.

ure 15 inches. In this case—if the roof be rather flat, say about one quarter pitch—four and a half inches is as far as they should be laid to the weather. In case a roof were quite steep it might answer to lay the courses four and three quarter inches to the weather.

When buildings are erected by the job, proprietors should give their personal attention to this subject, and see that jobbers do not lay the courses a half inch too far to the weather.

There is another important consideration which is too frequently overlooked in shingling, which is breaking joints. Careless workmen will often break joints within half an inch of each other. When the joints of the different courses come so close together, the roof will most certainly leak. Why should it not? There is nothing to prevent it during a heavy rain. Unless a roof is steeper than a quarter pitch,



CUTTING OUT THE RUBBER SHOES.

putting the shoes together, which we illustrate in Fig. 5, is by no means a difficult one, although it requires some skill. The lining and inside are attached to the last, and then the various pieces follow in succession, being secured in place by india rubber cement. Varnishing (Fig. 6) is next in order, and then it might be supposed that the shoe was complete—that is, to all appearances; but to feel the rubber is soon to be undeceived. It is soft and literally flabby; and although it has the shape of a shoe now, there is no reason to doubt but that, after a week's wear, the owner would find it half a dozen or so sizes too large, and more resembling a bag than a shoe. But here the vulcanizing process steps in to render the material hard and firm, yet elastic, and in a condition that, while the shoe may wear out, the shape will

in 1796, and was taught the cabinet maker's trade. About twenty-four years of his life were spent in South America, working as a mechanic at piano and furniture manufacture. He was an excellent workman and fortune favored him, so that he amassed some \$40,000. With this capital he went to California before the acquisition of that State by the United States, and, foreseeing the rise in value of real estate which followed the settlement of the country, invested his money in land. Meanwhile he started a flour mill, where it is stated he made the best flour offered in the California markets, and which always commanded a dollar or so a barrel above ruling rates. During his successful milling business, however, he never lost sight of his land investments, and he was constantly on the alert to buy up government titles given to soldiers and other tenures of property which the owners at that time believed would never become very valuable. In this way he acquired the ground on which the Lick House in San Francisco now stands, for \$40. That building Mr. Lick had built under his personal supervision, his mechanical knowledge standing him in good stead in constructing the elegant fittings of rare wood which embellish the halls and parlors. He likewise erected other large buildings on his land, most of which is in the heart of San Francisco, the city having grown round and upon it.

Not long ago, as we explained at the time, Mr. Lick set aside some \$5,000,000 from his immense fortune for various charitable purposes, and for the construction of an immense telescope, vesting the funds in trustees. Subsequently he reconsidered his project, and sought to change the conditions of certain portions of the gift, and in this way became involved in dissensions with his trustees which gave rise to the report that he had abandoned the project. It is hoped that no legal controversy may arise to prevent a construction of the magnificent telescope, to cost one million dollars, as provided for originally by the deceased. Mr. Lick leaves one son only, a man about 50 years of age, who was attending the Centennial Exhibition when his father died.

How to Lay Shingles.

Not one half the persons who lay shingles when making a roof on a building have any correct ideas in regard to making a roof that will be absolutely rain-tight during a driving storm of rain. We have frequently seen men shingling, who, when they would meet with a worthless shingle, say once in laying two or three courses, would lay this poor shingle among the good ones, saying: "It is only one poor shingle, one shingle cannot make a poor roof." But one poor shingle will make a leaky one. If first-rate shingles are employed, and one poor one is worked in among every 100, that roof might about as well have been without any shingles. If any poor shingles are to be used, let them all be laid together near the upper part of the roof. The best of shingles will not make a tight roof if they are not properly laid, while the same shingles would make an excellent roof if laid as shingles should be laid.



MAKING THE RUBBER SHOES.

much care should be taken to break joints not less than one and a quarter inches. Let all workmen and helpers be taught the vast importance of rejecting every poor shingle, except when the upper courses are being laid.—*Canadian Mechanic's Magazine.*

An Effort to Preserve the Main Exhibition Building.

The Philadelphia *Ledger* says that preliminary steps have been taken toward the permanent preservation of as much as possible of the utility and beauty of the Centennial Exhibition buildings and grounds. The suggestion has taken strong hold of a number of energetic and influential men, who have expressed their readiness to give the undertaking both moral support and material aid.

(For the Scientific American.)

SEASONAL BEHAVIOR OF PLANTS.

It has for some time been supposed that the heat of spring acts more powerfully or promptly upon plants in higher than in lower latitudes. De Candolle attempted to test this by planting, in some intermediate locality, seeds of several common annuals, taken from different latitudes. With the exception of one species of seeds, which one confirmed his opinions, he had in this way but indifferent success, owing probably to the fact that most of the seeds from the different latitudes represented unlike forms of variable species. It then occurred to him to make the trial with trees instead of seeds. Accordingly, in the early part of 1875, he sent for branches of four species of trees from Montpellier, and paired them with similar branches from Geneva. After subjecting them to the same degree of heat till all acquired the same temperature, he placed the pairs in glasses of wet sand in a warm room under exactly the same conditions. When these developed buds and leaves in the spring, he found that all the slips from the northern locality arrived at the same stage of vernalization earlier by from 18 to 23 days than those in the southern locality.

Two interesting considerations grow out of these facts, one of them practical and the other scientific in character. If these are facts, universal in their application, it will become a matter of considerable practical value in preparing vegetable products for market at the earliest possible moment. The great profits on many products of the soil depend largely upon their early introduction into market, when the demand is great and the supply small. If, by introducing seeds or plants from a northern locality, the gardener or fruit grower can make his crop ready for the market two or three weeks earlier, the advantages of such a course will not long remain unimproved. It is only necessary, by actual and sufficiently exhaustive experiment, to establish the truth of this theory in its application to all our seeds and plants, to gain for it universal acceptance.

In point of scientific interest appears the question why the same temperature acts more effectually upon the plant from the more northerly locality. De Candolle gives two answers to this query. First, that it may be due to natural selection of the buds. The earliest or most precocious have the advantage in the struggle for existence, while the latter ones are stifled. "In this way comes a selection and a successive adaptation of the tree to the climate." In connection with this, he furnishes incidental information respecting reversion. To illustrate the theory that the above result is accomplished because "every peculiarity of a bud is ordinarily reproduced year after year in the succeeding growth," he cites the case of a horse chestnut tree near Geneva, which, about the year 1822, first produced a single branch that bore double flowers, and has ever since borne nothing but double flowers, showing no tendency to revert to the single-flowered condition. This branch is supposed to be the origin of all the double-flowered horse chestnuts in the world, all others having been propagated from it by grafts.

The second reason why the northern plant develops, with the same temperature, more rapidly than the southern, is that the winter repose of the former is more complete than the latter; which, opines De Candolle, in some unaccountable way renders it more susceptible to the heat of spring. De Candolle attributes more importance to the latter explanation, while Dr. Asa Gray, in his comments, seems to incline to the former rather than to the latter.

The average time of the flowering of spring plants has been of late attracting considerable attention in Scotland. The Scottish Meteorological Society and the Botanical Society of Edinburgh have both been collecting data upon this subject. Both collections of facts have in view the advancement of meteorological science. The former society has given attention, for the past twenty years, to facts relating to the budding, leafing, flowering, and defoliation of trees and plants, and to the migrations of birds, in connection with the periodical return of the seasons. The material here brought together on this interesting subject has not yet been worked up so as to exhibit results; and before this is undertaken, it was decided to discuss the observations of Mr. McNab on the flowering of 32 spring plants in the open air in the Royal Botanical Garden of Edinburgh, during the past twenty-six years. These observations have been published in the "Transactions of the Edinburgh Botanical Society."

Mr. McNab's observations resulted in finding that the average time of flowering of the 32 plants taken had, during the twenty-six years, ranged in different species from January 25 to April 1, and later. He finds that the spring of different years varies considerably in the time of opening, it being sometimes thirty days later than the average, and again twenty-three days earlier: thus making a difference of fifty-three days between the earliest and latest springs during the twenty-six years. This average is obtained from observations on all the 32 plants; but when particular flowers are taken, the deviations from the mean are still greater. The greater deviations occur before the time of the equinox, when the time of flowering is often from five to seven weeks earlier or later than the mean. Unusually mild or severe weather before the time of flowering, as would be expected, greatly disturbs the plant in its season of maturation, yet it affects some plants more than others. For example, in 1864, when the preceding December was remarkably mild, and the following January and February colder than usual, one species of blue-eyed grass (*scyllanthus*), whose mean time of flowering was eleven days earlier than that of *daphne*, flowered eighty-six days before the lat-

ter. When such disturbances occur, of course no computed mean can be relied on, unless it be from data gained by observations recorded through a long series of years.

In Edinburgh, the mean temperature falls till January 11, and then slowly rises. Before the end of February, nearly half the 32 plants have flowered; and the very gradual rise in temperature to that time "suggests that it is not so much absolute temperature as the accumulated amounts of the preceding daily temperature, in the extent to which these rise above freezing."

If interest in this work can be sufficiently excited to prompt to the taking of observations similar to the above in other sections of the globe outside of Edinburgh and Scotland, we may expect results, in the science of meteorology, which will be not only most interesting but most profitable. We shall doubtless learn how closely the science of botany is related to that of meteorology, and how much insight we may gain into the intricacies of temperature and climatic influences by knowing the mean time of the flowering of plants in widely separated localities.

Another interesting matter, closely connected with the above, is the relation of color to the time of flowering of plants otherwise similar. Of the 32 plants observed by Mr. McNab, three were the blue, white, and red varieties of the species *scilla bifolia*. Of these, he found that the blue flowered first, and on the average ten days before the white, and the latter, four days before the red: making the difference of two weeks between the flowering time of two varieties of the same species, differing from each other only in color. The British wild flowers, to the number of 909 species, have been grouped according to their color and the month in which the flowers open. The results are very similar to those obtained by Mr. McNab. The order of colors in their average time of flowering is found to be, from earliest to latest, blue, white, purple, yellow, red, etc.

That the order of colors in spring flowers is from the outer colors of the spectrum to the inner has been several times observed by parties independent of each other; but others, in making like observations, have failed to see this order. Of course, to reach satisfactory conclusions on this point, an exhaustive study must be made upon all the colors of all the flowers, and the general average taken. Such exhaustive observations, continued from year to year for a long time, can hardly fail to result in very valuable knowledge as to the relative vitalizing power of the sun's rays in different seasons of the year, which will probably be available as well in the study of animal as of vegetable life. This also has a practical application in the rearing of early and late varieties of flowers and fruits.

It has been suggested that experiments be tried by excluding from the flower those colors of the sun's rays which the flower itself presents, in order to see what effect it would have upon the color and locality of the flower. In reply, it has been suggested that the reflected light would probably have less effect upon the plant than the absorbed light, and hence the object might possibly be best attained by excluding the colors complementary to those reflected.

Askenasy and others have experimented with flowers provided with sufficient food, but excluded entirely from light, and found that some changed their color and others did not. Mr. J. C. Costens suggests that the color may become almost constant by continued inheritance during a long lapse of time, and, consequently, be unaffected by the change of a few weeks or months. H. C. Sorby obtained results similar to Askenasy's, and concluded that "growing flowers in the dark seems to stop the normal development, to a greater or less extent, according to the nature of the coloring matters, the effect being greatest in the case of those substances which are the most easily decomposed."

An intimate connection has been observed between the seasonal order of color in flowers and the seeming "erratic behavior of certain radiometers." These eccentricities, observed in things so dissimilar as the color of flowers and the movements of radiometers, both affected by light, may lead us still further onward toward the eventual discovery of some new, or rather hitherto unknown, property or form of force existing in light.

S. H. T.

(For the Scientific American.)

THE BLESSINGS OF GUNPOWDER.

All inventions, of whatever kind, belonging to any period of man's existence on the earth, have proceeded from his wants; or as it is stated in the characteristic proverb: "Necessity is the mother of invention." It is indeed a fact that history, ancient as well as modern, proves the truth, first forcibly brought out by Darwin, that the mightiest cause of progress has always been, with man as well as with the whole vegetable and animal kingdom, the struggle for existence and the survival of the fittest. This struggle has not only improved individual man from his originally savage condition to that of civilization and finally to enlightenment, but, on a larger scale, has also served to promote the progress of nationalities, which has extinguished the weaker and less intellectual races of mankind, and exalted the stronger and more intellectual. This struggle for national superiority, which in its final result proves which are the really superior races, institutes, in its widest sense, war. In ancient barbarous and semi-barbarous times, bodily strength was the only superiority recognized, because it conferred on the possessor the means of compelling from others recognition and obedience; and hence in olden times the foremost leaders were always men of powerful frames, who could enforce obedience. This state of things lasted until the world was blessed with the invention of gunpowder, which equalized the power of individual men, as the bullet fired by a small man is as mortal as the bullet fired

by a giant. It made an end to oppression of the weak by the strong, and even gave the weak and small some advantage, as the chance of being hit by a ball is larger in proportion to the size of the individual, and *vice versa*.

The general introduction of gunpowder for purposes of defence was the most powerful cause of the downfall of feudalism, that curse of the middle ages, when the weak and poor had not only to work for the strong and rich, but to submit to the most glaring injustice. It was gunpowder which changed all that, because physical strength no longer gave entire superiority to its possessor, and the powerful soon found that he had to practise justice, even to the lowliest and feeblest of his neighbors and dependants. Gunpowder, then, has wrought the great social change which resulted in the lawful protection of the weak; and as necessity is the mother of invention, it is no wonder that this valuable invention was due to that state of society in which the most urgent wants are created, namely, a general war or struggle for superiority. This is a grand subject of contemplation for the deepest philosophical minds.

The saying that "gunpowder is the greatest civilizer" is therefore a profound truth. It is certain that that wonderful ancient nation, the Chinese, who knew it many centuries before the European peoples, had some degree of civilization at a period when Europe was still plunged into barbarism. At that time the Chinese had a perfect right to consider other nations as outside barbarians; and these nations made no considerable progress until gunpowder came into extensive use in warfare. Gunpowder at once put an end to the barbarous and demoralizing hand-to-hand fights, and has thus made wars less ferocious and less destructive, as it decides battles with far less destruction of life than was formerly the case. Even the improved appliances of the present day, the cannon of enormous size, the *mitrailleuses*, Gatling guns, needle guns, breech-loading rifles, etc., murderous as they look, and able to kill many men in a shorter time before, have, strange to say, an effect contrary to the theory, by which they would naturally be supposed to have the result of augmenting the list of victims in battles. Statistics of all the recent battles in which these appliances were used have indeed shown a much reduced slaughter of human beings, in proportion to the number engaged, than was the case in battles fought before these apparently very destructive and murderous inventions were adopted.

The greatest enemy in war is, at the present day, sickness, as was shown in the Crimean war, our Southern war, etc. Disease, indeed, has carried off or disabled more men than lead. But since chemical and mechanical ingenuity has conferred the blessings of gunpowder and improved firearms upon the world, it is now the business of physiological and medical science to apply knowledge and skill, and devise means of introducing sanitary measures to preserve the health of the soldier, and to reform the treatment of the sick so as to reduce mortality in the hospitals to a minimum: for as we have stated, the mortality by battles is, on an average, notwithstanding that appearances point the other way, less than that by disease in the hospitals.

It is a subject of just national pride that many of the measures taken by the staff of our military health officers has been so proper and effective that they have excited the admiration of all the world, and been imitated and introduced by several European nations. The principal cause of this, we should state, is that, according to the acknowledgment of the heads of this department, their plans were not thwarted by interference by non-medical superiors, as is the case in European armies. Our medical staff has an independent existence, enjoying the direct support of the United States government, which gives it *carte blanche* to carry out its own views on the important functions it is called upon to perform. How effectively and honestly this has been done, and the confidence placed in the medical officers been justified, the history of our war fully and conclusively proves.

A New Dye Stuff.

Ch. Lauth has succeeded in producing another new class of dyes by the introduction of sulphur into aromatic diamines, and then oxidizing the new sulphur compound. On heating phenylene-diamine (made from nitro-acetic anilide) with sulphur, to 150° or 180° C. (300° or 356° F.), sulphuretted hydrogen gas is evolved, and a new base containing sulphur is formed. This base is converted by oxidizing agents into a beautiful violet dye.

The same substance can be obtained in a more simple manner by dissolving the muriate of phenyl-diamine in a large quantity of sulphuretted hydrogen water, and slowly adding sesquichloride of iron. The precipitate formed is washed with a weak salt solution and recrystallized from hot water. In the dry state this dye consists of very fine curved and intricate needles of dark green luster. It is soluble in pure water, but foreign substances change its solubility; with caustic soda it yields a brown precipitate, probably the free base. Reducing agents destroy the color of the violet substance; oxidizing agents destroy it quite quickly. Like the ordinary aniline dyes, it may be modified by substitution; with aniline it produces a blue dye insoluble in water; with aldehyde or iodide of methyl it gives a green, which attaches itself directly to the fibers. Cresylen-diamide from nitrated ortho-acetoluidin gives, under similar conditions, more of a reddish violet; cresylen-diamine, corresponding to paratoluidin, gives a violet red. These new dyes contain sulphur.

CEMENT FOR WOOD VESSELS REQUIRED TO BE WATER-TIGHT.—A mixture of lime clay and oxide of iron separately calcined and reduced to powder, intimately mixed, kept in a close vessel, and mixed with water when used

THE PROCESSES OF STEEL MANUFACTURE.

The manufacture of steel by a process as simple as possible, at the lowest cost and of the best quality, has called forth, especially of late years, the exercise of much inventive ability on the part of both chemists and engineers, both at home and abroad. There has resulted such a variety of differing methods that some systematic classification of the processes has become very necessary. In the *Mittheilungen des Hannoverschen Gewerbe-Vereins*, Professor Heeren publishes the complete classification, a translation of which is given below, and which will be found both instructive and of value for purposes of reference. As steel occupies nearly the middle place between cast and wrought iron in its proportion of carbon, it may be prepared either by decarburizing pig iron, or, on the contrary, by causing wrought iron to absorb carbon. The processes to accomplish these ends may be arranged under five principal heads: A, Fabrication of steel by decarburization of crude or pig iron; B, by carburization of wrought iron; C, by mixing a wrought iron poor in carbon with a pig iron rich in same; D, by mixing pig iron with ore (the pig yields carbon which reduces the ore and transforms the reduced iron into steel); E, directly by means of ore; F, cast steel. Subdividing these systems, we have the following methods under each heading.

A.—METHODS BY DECARBURIZING THE CRUDE IRON.

1. Steel obtained by a long heating of the crude iron in an oxidizing atmosphere, the metal not being brought to fusion. (a) Tunner's method in sand, where the decarburization is produced by means of the oxygen in the air. (b) Julien's method, in forge scales or spathic ore. This produces malleable iron. (c) Herzeles' method in steam; (d) Thomas' method in carbonic acid. The last two processes have not been employed to any great extent.

2. Natural steel: In this method, employed since the earliest times, the crude iron is melted in a refining furnace with wood charcoal, and decarburized by the ferrous oxide of the scoria. The product is purified by a repeated refining.

3. Puddling: This process is the same as the preceding, from a chemical point of view, but is practised in a reverberatory furnace heated with coal. It is necessary to purify the product by repeated refining or by transforming it into cast steel.

The construction of puddling furnaces has undergone many changes. We may distinguish (a) the ordinary puddling furnace with fixed hearth and heated by coal, (b) the same heated by lignite or peat, (c) the puddling furnaces of Schaffhütel and others, with mechanical rabbles designed to diminish the labor so fatiguing to the workman. These, however, have been entirely superseded by new systems. (d) The Danks furnace, the hearth of which is formed of a hollow cylinder placed horizontally, and turning about its axis. It gives a product of excellent quality, and is economical. The interior lining, however, is difficult to maintain. (e) The Ehrenwerth furnace has a horizontal circular hearth turning about a vertical axis. (f) The Pernot furnace also has a circular sole, which, however, is not horizontal, but slightly inclined, so that during its rotation the iron and scoria run to the lowest point and are thus in a state of continual motion; while the elevated parts of the hearth, together with the iron and scoria thereto adherent, are submitted to the oxidizing action of the air. Professor Heeren thinks this furnace to be the best, because it realizes the advantages of mechanical puddling without needing any special lining.

4. The Bessemer process: A current of air, finely divided, is passed through the liquid crude iron. The carbon, silicon, and a part of the iron burn, and the temperature is so highly elevated that the iron, decarburized in part or transformed into steel, remains molten. It is then run into molds.

5. Bérard's modification of the above: Air and gases are alternately introduced into the retort with different advantages.

6. Peters' process: The liquefied crude iron in a reverberatory furnace falls in the form of rain in a vertical chamber in which the furnace gases also pass, and in which air is blown so as to decarburize the metal to the desired degree.

B.—METHODS BY CARBURIZATION OF WROUGHT IRON.

1. Indian or Wootz steel: Wrought iron of extraordinary purity, obtained by treating a very pure ore in small chamber furnaces by the direct method, is hammered, made into bars, cut into short pieces, and placed in small crucibles with a few green leaves. The crucibles are hermetically sealed and heated for a long time at a high temperature. The iron is transformed into steel by uniting with it this carbon contained in the leaves, and the steel even partially melts. These half melted masses furnish the famous sword blades and plates of Persia and Damascus.

2. There are several other processes resembling the Indian, which, however, are not carried on on a large scale. There are (a) the Mushet process, in which wrought iron obtained by the ordinary refining method is melted with powdered wood charcoal. (b) The Vickers' process, analogous to the preceding, with the addition of oxide of manganese. (c) The Stourbridge, Brooman, Thomas, and Binks processes, based on identical principles.

3. English cemented steel: Wrought iron of the best possible quality is, in the shape of bars, packed in clay boxes, together with wood charcoal coarsely pulverized. The heating continues for two or three weeks. Without melting, the iron is changed into steel, which by remelting is transformed into cast steel.

4. Parry's cupola steel: Fragments of wrought iron, melt-

ed in the cupola with a large consumption of coke or wood charcoal, may be transformed into steel or even into cast iron according to the length of the operation. This system offers an advantageous method of utilizing scrap, and requires no special apparatus.

5. Chenot's process: In this the ore is reduced by heating it progressively with coal. A non-melted iron sponge is obtained, which is ground and separated as well as possible from the gangues by the aid of a magnet. Lastly, it is mixed with carboniferous substances, and melted under pressure. The principal disadvantage of this process is the difficulty of separating the gangues without losing the steel.

6. Casehardening has for its object the transformation of the surfaces of wrought iron objects into steel. It is done in two ways. (a) The pieces are placed in small sheet iron boxes and surrounded with chips of wood. The boxes are hermetically closed and heated in a forge fire, for 15 or 20 minutes, to an intense red heat. They are then removed quickly, opened, and their contents thrown into cold water, whereby the exterior steel shell is rendered as hard as glass. (b) The pieces are heated to a whitish red and moistened with ferrocyanide of potassium, which acts, by its cyanogen, on the iron, and transforms the surface into steel.

C.—METHODS BY FUSION OF A MIXTURE OF CAST AND WROUGHT IRON.

The two materials may be, both or only one of them, used in a melted state.

1. Bessemer steel, prepared by the ordinary method. The crude and wrought iron here are both liquid, while, as we have previously said, cast iron may be directly transformed into steel. The method most followed, and which leads most surely to the end in view, consists in completely decarburizing the crude iron in the converter, and in adding to the melted metallic iron a rigorously determined quantity of liquid crude iron. The carbon of the latter affects the previously decarburized iron, and makes a steel containing a given proportion of carbon.

2. Crucible steel is obtained by melting in crucibles a mixture of crude and wrought iron. The former liquefies first, and slowly melts the latter.

3. Martin's steel is similarly made, by replacing the crucible with a reverberatory furnace. The crude iron is liquefied under a thin layer of scoria on the concave hearth of a reverberatory furnace, heated to an intense red-white heat by a Siemens regenerator. Scraps of steel and wrought iron of all kinds in desired quantity are added, and the steel is run into molds of cast iron.

D.—METHODS BY A MIXTURE OF CAST IRON AND ORE.

Uchatius steel: The cast iron is granulated by running it into water while molten, and the grains are melted with spathic ore, peroxide of manganese, and wrought iron in crucibles. The ferrous oxide of the spathic ore is reduced by the carbon of the cast iron, and the surplus of carbon unites with the wrought iron to make steel.

E.—METHODS BY PREPARATION DIRECT FROM THE ORE.

The Siemens direct process: The ore is melted alone, without addition of reducing material, at a very elevated temperature; then the iron is reduced and transformed into wrought iron or into steel by adding coal.

F.—CAST STEEL.

For the purification of steel by fusion, cemented, forged, and puddled steel are employed. To improve the qualities of the steel, and notably to augment its hardness, diverse substances are added. Thus we have: 1, silver steel, 2, nickel steel, and 3, wolfram or Mushet special steel.

THE RUSSIAN SYSTEM OF TRADE EDUCATION.

Our correspondents at the Centennial Exposition have already briefly described the courses of study in many of the institutions of learning there represented. There is one great school, however, which is worthy of something more than passing notice; and for many reasons its exhibit may be profitably studied by all interested in the important question of how best to impart practically valuable technical education. While, with all mechanical schools, the cardinal object of the Imperial Technical School of Moscow, Russia, is to eliminate all useless or routine labor in the acquisition of a trade, and to require the student to perform only such as is best adapted, in connection with proper advice, to give the necessary knowledge, it adopts to this end a different method from any hitherto practised; and for the first time it has successfully proved the value of absolutely systematic instruction applied to the acquirement of industrial skill. The method of teaching the mechanical arts here initiated has gradually spread itself into all the Russian technical schools; and it is not unsafe to believe that, judging from the reported results, the same must eventually supersede other modes of instruction elsewhere. It is our purpose in the following to exhibit briefly the practical way in which the system is carried on.

The auxiliaries of education appointed for the teaching of any mechanical work whatever—for example, fitting—are divided into three categories. Taking fitter's work as an example, under the first division belong collections of tools used in the various operations, with which the beginner must make himself perfectly familiar before entering upon practical labor. Some of these collections are exhibited at the Centennial. There are collections of instruments for measuring, for drilling, and for finishing, models of files increased to 24 times ordinary size for the purpose of exhibiting the shape of teeth, etc., models of taps and dies magnified 6 times for the study of the direction of the

angles of incision, and models of drills similarly magnified for the practical study of cutting angles; and there is also a collection of instruments and apparatus for teaching the tracing of yet unworked metal articles. Similarly in turning both in metal and wood, and in joinery, there are like collections, in which every tool is represented either in actual or in largely magnified form, so that the most accurate knowledge is thus imparted relative to every characteristic of the implements.

Having learned what he is to work with, the student is next taught practical manipulations. These are included in the second category, and it is worth while to review them. In wood turning, the pupil begins by following exercise models of various channellings, then he learns to turn a cylinder, a cone, a bullet, and so on, through thirteen articles, up to a vase and cover. In model and pattern making, the first lesson is to saw straight and along fiber, then to saw in a curved line, then to plane wood of different sections, to make joints, and the last of 25 operations is cross scarring by a skew abutting. At the forge, the student begins by forging square out of round iron, then round out of square. Nuts are next made, then screw heads of all shapes, then bolts of various kinds, then welding and steeling; and the last operation is to make welded ears to square bar iron. Metal turning starts with a simple cylinder and ends with right and left worms of a screw. Fitting begins with cleaning castings, which is followed by chiseling of various surfaces. There are 29 filing operations, beginning with the filing of thin edges according to marked lines, and ending with the filing of cast conical apertures. Then come punching and boring, drilling, and finally screw cutting.

These are merely general operations. Models are followed and the work is accurately graded, so that the beginner overcomes by degrees the difficulties presented. The teacher sees that each number of the programme is satisfactorily executed, and keeps the learner on that particular piece of work until it is mastered. Then the next operation in the series is undertaken, the instructor giving all the requisite explanations. Hence it is impossible for a student to become a good chiseler and a poor filer at once, or skillful at the drill and bungling with saw and plane. In every course the order is inflexibly followed, and the acquirement of each integral advance is the only road to progress.

Lastly comes the third category, or the practical application of all that has been learned. And here another series of lists meets us. But instead of the objects being, as it were, merely abstract, they are parts of machines, etc., selected so that in their execution all the practical resources of the art which the pupil has been studying are brought into play. The wood turner begins by producing a stuffing box cover. Then follows the shell for a step, a valve with a bullet seat, oil cups, rollers, star and bevel wheels, cylinder cover, same with stuffing box, pulley, and so on through a list of 43 pieces, ending with the chamber of a bullet valve. The model maker following models of wood joinings starts with a tongue joint, and, after producing 25 kinds of joints, scarrings, etc., begins on patterns. The list includes a grate bar, crank, puppet, wall box, sheave drum, and eccentric bevel wheels; and the eighteenth and last requirement is a set of patterns for a horizontal feed pump. The metal turner makes a steam cylinder, piston, cylinder cover, and lastly a crank shaft. The last five operations required of the fitter are the fitting of a toothed coupling, of a clutch coupling, of brasses to a plunger block by five planes, of a paralleloped to an aperture, and the fitting of sliding plates.

That the pupil who has gone through this course becomes a skilled workman, it is hardly necessary to point out. He must be so if he succeeds in graduating at all. But all this is merely preliminary. The student has yet to learn to be an engineer, and to this end he has been taught theory for a portion of his time. He now advances to a new school of practice, namely, the mechanical works. There, while he may not labor at the bench himself, he sees others do it, and he is taught construction. There is a large force of hired workmen carrying out orders on a commercial footing, for engines and machines of all kinds. There are iron and brass foundries, engineers' shops, builders' shop, forge, joiners' and painters' shops, drawing office, and counting room. The student is obliged to study everything, from iron smelting to book keeping, and thus his course is completed.

It is the fortune of a large number of graduates of the scientific courses of our colleges, when thrown for the first time upon their own resources, to take positions as draftsmen; some few enter works to learn the practical part of a trade. The latter are neither apprentices nor skilled hands. Those who become draftsmen, not possessing as a rule the practical groundwork for an industrial career, nor from their position having opportunities for acquiring the same, too often remain draftsmen for their best years, if not for all their lives. The trade learners, meaning some day to follow their profession, perhaps learn the truth that, while the professions are overcrowded (except at the top), the trades are not, and, concluding to adhere to the trade, become educated to a certain branch, and, under the principle of the division of labor (in these times constantly expanding), find in the end that their knowledge is confined within the limits of a narrow specialization.

With such an education as we have outlined, it is difficult to imagine either of the above results; for even should professional opportunities fail, the shop is ever open to a workman whose skill is as broad as a trade itself and not confined to any one branch thereof. Such acquirements, moreover, could not be of the greatest value to any person in any walk of life. The Emperor of Germany, should he lose his crown, can earn a good living by setting type, for he is an excellent practical compositor and printer. The Queen of Eng-

TABLES FOR SYSTEMATIC QUALITATIVE CHEMICAL ANALYSIS. By John H. Niveley, Ph. Dr., Professor of Analytical Chemistry in the Tennessee College of Pharmacy, etc. Price \$1.00, post paid. Nashville, Tenn.: C. W. Smith, 158 Church street.

range in tabular form, and are well adapted for the use of students, as an introduction to the voluminous literature on the subject. Much of the matter is new and original; and the author's explanatory notes give many details of manipulation, and point out the precautions to be observed by the operator. The book bears promise of much utility.

LIVER COMPLAINT, NERVOUS DYSPEPSIA, AND HEADACHE: Their Causes, Prevention, and Cure. By M. L. Holbrook, M.D., Editor of the "Herald of Health," etc. New York city: Wood and Holbrook, 13 and 15 Laight street.

The treatises on health and disease which have been published in great numbers of late years do not seem to have diminished the crowds of patients who flock to the doctors in search of remedies for dyspepsia, liver complaint, and other troubles, brought on, as Dr. Holbrook points out, mainly by gluttony, intemperance of all kinds, and laziness. This little book gives the only recommendation possible in such cases, namely, moderation in food and drink, care in the choice of food, exercise, and cleanliness. It is not much to the credit of the invalids and hypochondriacs of our day that these remedies have to be so frequently prescribed.

THE WOOL CARDER'S VADE MECUM, a Handbook of Woolen Industry. By W. C. Bramwell. Terre Haute, Ind.: Hebb and Wigley.

An excellent treatise on a little understood specialty. The tables and formulae for calculating speeds, etc., are especially valuable.

A SONG OF AMERICA, AND MINOR LYRICS. By V. Voldo. New York city: Hanscom & Co.

The "Song of America" commences: "When Earth was but a fledgling, and her race first entertained the everlasting space," etc. The author does not explain where earth's race lived when earth's feathers began to grow, nor the nature of the entertainment to which everlasting space was invited; but he puzzles his readers with a wilderness of riddles of the same kind, and astonishes them with seventy pages of matter that defies the interpreter, and laughs him to scorn. Every line in the book has a sphinx-like impenetrability about it that would be exasperating if it were not perfectly easy to place the volume in the basket thereunto appointed.

Mr. F. GUICHETEAU has recently patented a newspaper file of very convenient form. It consists of a paper box, made in the shape of a book and appropriately lettered on the back. Inside the box, where the backs of the papers are, are cross wires for filing the papers on, and a steel spring for holding them tightly in place. The files are made and sold by Mr. F. Clerget, 1,375 Broadway, Brooklyn, N. Y.

W. E. MARSHALL, artist, has made some fine steel plate portraits of the candidates, which are published by O. Marshall, 697 Broadway, New York.

Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED HAND CULTIVATOR.

James S. Lucas, Bowling Green, Ky.—This consists of a hand cultivator with V-shaped arms, having a suitable number of teeth and curved cutting knives at the front part. It is readily used between the rows of vegetables, and forms thus a convenient implement for field and garden use.

IMPROVED MOWING MACHINE.

Frank Pastorius, Quincy, Ill.—This is an improved device for giving motion to the sickle bar of reapers and mowers. To the journals of the gear wheels, which engage with the drive wheels, are rigidly attached two cams, set in opposite directions, so as to alternately push against the opposite sides of, and thus oscillate, a lever, which is connected with the sickle bar.

IMPROVED FEEDER FOR THRASHING MACHINES.

John Potterton Flson, Teverham, England.—This invention relates to a combined drum guard and feeder for thrashing machines. It is designed to prevent accidents by making it impossible for any person to fall upon or be drawn into the drum, and to act, also, as a feed regulator. Should any unusual weight come upon either the cylinder or the upper part of the feed board, the cylinder instantly descends upon the feed board, and the lower at the same time rises to meet the cylinder. The cylinder and feed board being thus brought together, the feed opening of the machine is entirely closed.

IMPROVED HARROW.

James M. Flower, Traverse City, Mich.—The harrow frame is formed of four sections, each section consisting of three bars, arranged in the form of the letter N, connected at one end by a cross bar, and hinged together in pairs.

IMPROVED STRAW CUTTER.

Hugh G. Fladger, Lilesville, N. C.—The balance driving wheel has an eccentric groove in one side, in which a roller works to operate the cutter lever, the roller being mounted at one side of the free end of the lever on a pin.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CAR COUPLING.

John Slade, Bay City, Mich.—This invention relates particularly to the form of the shank of the hooks, and to the provision of beveled blocks, attached to the side of the hooks, whereby the latter are adapted to be uncoupled when raised to a slight angle.

IMPROVED COAL CHUTE.

Edmund R. Bulkley, Perth Amboy, N. J.—This consists in the combination, with an adjustable discharging chute section and the feeding bin of an adjustable and intermediate section having a sieve bottom for sifting out the fine coal as it passes from the bin, and for preventing a too violent fall of the coal into the hold of the vessel.

IMPROVED HAY AND COTTON PRESS.

Isaac N. Ward, Henryville, Tenn., and Hugh R. White, Lawrenceburg, Tenn.—This invention is an improvement in cotton presses of the modern type, in which the upper end of the box is left open for filling, and the follower is worked from beneath. The head and sides of the press box are made removable, and the ends travel with the follower, which is operated by pivoted levers. The said levers are connected by movable clamps or dogs, with vertical rods which are pivoted to the ends of the follower, and attached, at their upper ends, to the sliding or traveling ends of the press box; so that as the levers are vibrated, the clamps or dogs bite on said rods, thereby raising the follower and the ends of the press box and the rods simultaneously. The said ends are made in sections to facilitate the removal of the bale.

IMPROVED CAR COUPLING.

Alvin K. Mott, Atlantic, Iowa.—This consists of a drawhead, with sliding and spring-acted block, and a fork-shaped locking piece that slides in side grooves and top perforations of the drawhead, and couples the arrow-shaped head of the link. The forked lock piece is made wider at the lower parts of the legs to admit the forward motion of the spring block and the seating of the lock piece on the forward projecting top flange of the same.

IMPROVED MANDREL OR CORE FOR CASTING.

James M. Rohrer, Shamokin, Pa., assignor to himself and William L. Follower, same place.—The flanges for holding the parts of the mandrel together are bored out tapering to fit the tapering ends of the shell, so as to be easily removed. The shell is cut lon-

gitudinally to receive a beveled key, which is cut beveling, so that it will give toward the center, as the shell contracts when the center plug is given from the shell to relieve the pressure caused by the shrinkage of the casting in cooling. This sectional mandrel is used in casting cylinders of any kind that require hard and smooth inner surfaces.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WHIFFLETREE COUPLING.

Asa T. Martin, Jr., Waverly, Iowa.—This is an improved coupling for connecting whiffletrees with the double tree, and the double tree with the tongue, so constructed as to prevent them from tipping or turning over. It also causes the end that moves forward to rise, so that it will return to its place. The coupling bolt, which is rigidly attached to a washer, is bent at an angle at its point of intersection with said washer. The washer is made thicker upon one side than at the other, to counterbalance the angle of the bolt and give the whiffletree a firm seat.

IMPROVED SAWMILL DOG.

Alfred Mephram, Fayette, Ohio.—This invention consists of a dog, mounted on a block, which slides up and down on the standard, with a crank pinion and toothed bar for working it, and a ratchet lever for applying great force to press the dog into the log. There is also a secondary plank dog detachably connected to the block carrying the principal log dog, and contrived with a cranked screw nut for drawing the plank up to the standard, in addition to the contrivance for pressing the dogs down into the timber.

IMPROVED SASH BALANCE.

W. Woodward, Nashville, Tenn.—The object of this invention is to provide a simple and efficient sash balance, in which the cords carrying the suspended weight shall be concealed from sight and yet arranged so as to permit the raising or lowering of each sash to its entire length. To this end the invention consists in grooving the sash upon its edges and attaching the cord to the same at the bottom, then passing it between two pulleys, arranged about the middle of the window frame, and thence around a third pulley, located about the center of the window.

IMPROVED COMPOSITION PAINT FOR COATING ROOFS.

Thomas Dana and Zechariah B. Stuart, Manchester, N. H.—This compound may be used as a waterproof coating for any purpose. It is not affected by heat or cold, and is light and durable. It is composed of gutta percha, isinglass, chloroform, and rosin, japan and asphalt varnish.

IMPROVED LOCOMOTIVE WHEEL.

Wilson Weathersbee, Spring Garden, Ill.—This is a new method of gearing one or both of the driving wheels of a locomotive, so that they can turn independently of each other in going around curves, and thus prevent sliding, as when both wheels are keyed fast to the axle.

IMPROVED PUMP.

David N. Green, Rockbridge, Ohio.—The novel feature consists in detachable plugs held over lateral apertures in the pump stock by sliding keys, by which plugs the water in cold weather is allowed to run out.

IMPROVED HORSESHOE BLANK.

James N. Whitman, Pembroke, Me.—This consists of a rolled bar of iron or steel, having formed on one side thereof, in process of rolling, calks for the heel and toe and a nick at the end of each blank. Upon the reverse side is a clip for the toe, and nicks corresponding to those on the calk side.

IMPROVED SIGNAL ATTACHMENT FOR ELEVATORS.

Charles Hoffman, New York city.—This consists of an elevator or dumb waiter, arranged with a number of separate pulls and catches for each story, that come in contact with a signaling or alarm device of the corresponding story when raised to the proper height.

IMPROVED SAW SWAGE.

Asher Willey, Rochester, Mo.—This consists of a recessed stock, provided with shaping dies of different curvatures, that are set into the recesses of the stock, and locked by an inclosing sleeve. The swage is applied to the tooth and driven by a mallet on the same, so that a cutting edge corresponding to the curvature of the shaping die is formed, and thereby a tooth of greater or less cutting power obtained.

IMPROVED SUGAR MILL.

James Mallon, Baton Rouge, La.—This invention consists of a sugar mill, arranged with a perforated steam pipe in front of the receiving rollers, and one or more perforated steam pipes in the cane knife for forcing small jets of steam up through the cane as it passes over the knife or turn plate.

IMPROVED CAR REPLACER.

Homer G. Brooks, Greenville, S. C.—This consists of a casting that rises gradually on an inclined plane from the broader lower part to the narrower higher end, at a level with the rail, being fitted thereto by bottom recesses and rail head binding wings. Guide grooves and flanges lead the car wheel to a key, socketed at suitable angle at the highest end of the replacer, to transfer then the wheel to the rail.

IMPROVED COTTON PRESS.

William H. Horn, San Augustine, Tex.—This relates to the press on which a patent was granted May 5, 1875, to William B. Hollowell; and it consists of a duplicate master wheel on the drum for working the follower: also an improved contrivance for connecting the pitman to the lever and to its pivot, whereby the machine is rendered more efficient, and may be made lighter for a given strength.

NEW HOUSEHOLD INVENTIONS.

IMPROVED APPLE CORER.

Isaac Rogers, Sheridan, Oregon.—This invention consists in combining with a fork, coring tube, and cutter, a cross piece having top pins, whereby the pared and sliced apple is automatically removed. The forward stroke of tube and blade cores and cuts the fruit, while the return stroke carries the core back and drops the divided fruit.

IMPROVED CARPET SWEEPER.

Samuel F. Leach, Chelsea, Mass.—This invention consists in carpet sweeper gear wheels made of leather, treated with a hardening and waterproofing substance or substances. Leather is better than wood or metal because it is entirely noiseless and will not tear the carpet, and it is also superior to rubber or rubber compound, as it will always preserve its round or true shape, which is not the case with rubber wheels.

IMPROVED SUSPENSION BED SPRING.

James W. Wright, Washington, D. C.—This invention relates to an improved construction of suspension bed spring; and it consists in detachable wire springs bent so as to form seats in which the ends of the slats are suspended, the said pieces of wire having their

middle parts bent into coils, through which passes a rod, and their ends extended upwardly in the form of arms terminating in hooks. The seats for the slats project laterally from the said rod, which latter, passing through the coils, operates as a pivot for the same, while the upwardly extending hooks are detachably fastened to the end frames of the bedstead and sustained in a suspended position.

IMPROVED AUTOMATIC FAN.

Morris Ruben and Herman K. Bradshaw, Alexandria, Va.—The object of this invention is to provide a cheap and available motive power for driving fans, with a force sufficient to produce a current of air over a dining room table, bed, or sick couch, thereby accomplishing the double result of supplying a cool current of air, and driving away flies, mosquitos, and other troublesome insects. To this end the invention consists in an overshot wheel, arranged to be operated by a stream of falling sand or water, and combined with peculiar mechanism for operating the fan.

IMPROVED FRUIT JAR RACK.

Stokley D. Dilts, Lawrenceville, Ill.—This rack consists of bars and frames, the latter being provided with opening to allow the top to be secured at a greater or less elevation above the bottom to suit jars of different heights.

IMPROVED FURNITURE CASTER.

Benjamin E. Flanders, Brooklyn, N. Y.—This consists of a caster, the socket of which is provided with an interior concavo-convex glass shell, which extends from the upper point of greatest pressure, and bears on a revolving ball that is retained by an outer metallic casing. The friction between shell and ball being reduced to a minimum, the wear is decreased.

IMPROVED CARPET FASTENER.

John H. Campbell, New York city.—This consists in a carpet fastener made of sheet metal, and having key holes, which allow it to be placed over and slid under the heads of rivets. When the fastening nails are placed in position, and the carpet cut, sewn, and stretched, the edge of the same is carried by the flat knife under the clamping top part, and the knife then withdrawn. The toothed part of the fastener takes firmly hold of the edge of the carpet, and prevents its escape, whatever be the strain thereon.

IMPROVED REFRIGERATOR.

Mahlon Moon, Morrisville, Pa.—Between a preserving chamber and the ice chamber, a fibrous or absorbent material is placed to collect and carry off the moisture condensed from the air. This furnishes a simple device for preventing injury to fruit, etc., by dampness.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED FOUNTAIN PENHOLDER.

Almerrin P. Allen, Denmark, Iowa.—This is an improved fountain penholder that supplies the required quantity of ink to the pen during writing, while holding at the same time the main body of ink in check, and conveying it in regular and even manner to the point of the pen. The novel features are a cap extension and beveled point, connected by narrow side strips, that fit the shape of the pen.

IMPROVED FUNNEL.

John O. Barton, Chicago, Ill.—This is a convenient device for grocers and others dealing in sirups. The invention consists of a funnel, with an interior plug, to close the discharge spout, and cross wires to indicate the quantity to be measured. The funnel has a hermetically fitting screw cap with a central air tube, to which the pipe, connecting with a force pump applied to the barrel, is attached, so as to force the sirup quickly into the jug.

IMPROVED COMBINED ELECTRIC FIRE SIGNAL APPARATUS AND FIRE EXTINGUISHER.

Thomas F. Nevins and John W. Smith, Brooklyn, N. Y.—With the pipe through which the water is brought into the building and in the upper part of the room is connected a perforated pipe through which the water is discharged into the room, and in which, near the pipe, is placed a stopcock. To the handle of the stopcock is attached a weight. The stem of the weight is made with an eye to receive a pin, that is held back by a spring and is held forward by a cord which is led to different parts of the room, so that, should a fire occur, the flame may burn off the cord and cause the weight to drop, which opens the cock and causes a discharge of water into the room. In the pipe is placed a small water wheel, which, when the cock is thus opened, rotates thereby, sounding an alarm.

IMPROVED TOY CAMERA.

August Herzog, New York city.—This is a photographic apparatus, of simple construction, consisting of an upright frame, to which a camera, with sliding lens tube, is applied. Supports are also provided for a ground glass and plate holder.

IMPROVED ELECTRICAL APPARATUS.

Jerome Kidder, New York city.—This apparatus is designed for medical use, and includes several novel devices. A portion of a series of battery elements, arranged for transmitting a circuit through the body, are adapted to operate an induction coil. A new means is provided for substituting fresh fluid for that which has become spent in power, in the elements. There are new supports for the induction coil, and some novel arrangements for modifying the force of the induced currents.

IMPROVED PROCESS FOR THE MANUFACTURE OF RAWHIDE.

William Coupe, South Attleborough, Mass.—This improved process consists in submitting the hides or skins from which the hair has been removed to a succession of baths composed of a solution of lime, etc., and, when partially dry, coating them with a mixture of tallow, beeswax, and paraffin, and then submitting them to the action of a revolving drum or other suitable softening apparatus.

IMPROVED TOY PISTOL.

Otto C. Butterweck, St. Louis, Mo.—This invention consists of a pistol in which any projectile is impelled from the barrel by a concave-faced piston, around the rod of which is coiled a spiral spring. The piston rod is drawn back by means of a button or loop on its rear end, and is retained in position by a projection, on a spring trigger, which catches against the front surface of the piston; the spiral spring being compressed between the latter and the inner surface of the rear end of the pistol.

IMPROVED BUCKLE.

Charles W. Higinbottom and Frederick F. Smith, Vandalia, Ill.—This invention is an improvement in that class of buckles in which the tongue is made detachable and entirely separate from the frame. The tongue of this improved buckle is provided with a rib or lug in the center, and with claws or points on its ends, which pass through holes in the strap or straps, to which the buckle is applied. When the tongue is adjusted in place, the rib or lug prevents displacement of the end of the strap, and aids the claws in sustaining the strain to which the strap is subjected.

IMPROVED BARBED FENCE WIRE.

Rollin G. Brown, De Witt, Iowa.—This consists in an improved fence wire, formed by interlocking with each other sections, having loops and barbs formed upon their ends.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Agricultural Implements and Industrial Machinery for Export and Domestic Use. R. H. Allen & Co., N. Y.

Latest and Best Books on Steam Engineering. Send stamp for catalogue. F. Keppel, Bridgeport, Conn.

Fire Hose, Rubber Lined Linen and Cotton, finest quality. Eureka Fire Hose Co., 15 Barclay St., New York.

Tool Chests filled with the very best tools are furnished by James T. Pratt & Co., 55 Fulton St., New York. Circulars sent.

Paper Pulley Cover to prevent Belts from slipping—Patent for Sale. Address J. de Vries, 114 Wooster St., New York.

Middleton's Chemical Writing Fluid—Best made in America. Send for Price Lists. Union Chemical Co., Harrisburg, Pa.

English Patent for Sale—New Invention of great utility. Now having large sale in U. S. and Canada. W. H. Hayward, 291 Broadway, New York.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocom & Son, Drinker St., below 147 North Second St., Philadelphia, Pa.

Rare Chance—Steam Factory for Wagons, Carriages, Agricultural Implements, &c., at Lisbon, Iowa. \$15,000 worth of property for \$10,000. Terms easy. For particulars, inquire of W. G. Power, Mt. Vernon, Iowa.

The Gothic Furnace for Wood and Coal combines many improvements in heating, after 15 years of trial stands unrivalled in economy, durability, purity of air. Send for catalogue. A. M. Lesley, 236 W. 23d St., N. Y.

Hearing Restored—Great Invention by one who was deaf for 30 years. Send stamp for particulars. Jno. Garmore, Lock-box 905, Covington, Ky.

Wanted—Situation by a Practical Chemist experienced in manufacture of dyers' chemicals, fertilizers, utilization of ammonia-water. Humboldt Bank, Erie, Pa.

Picture-Frame Machine—Foot or Power. Makes frames easier and better than 1 by old way. New thing. \$80 to \$125. E. L. Eastman & Co., Washington, D. C.

At a Bargain—Centennial Exhibition Shafting. Four lines of 2½ and 3 in., complete. 65 ft., 105 ft., 120 ft., and 170 ft. A. B. Cook & Co., Erie, Pa., or D. 9, 72, Machinery Hall.

Wanted—A first class 24 Hand Foot Lathe, Tools, &c. Screw cutting preferred. W. N. Callender, Albany, N. Y.

Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability, are cheaper by comparison than any others extant. 246 Grand St., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

For 13, 15, 16 & 18 in. Swing Engine Lathes, address Star Tool Co., Providence, R. I.

The Scientific American Supplement—Any desired back number can be had for 10 cents, at this office, or almost any news store.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., 300 Newmarket, N. H.

Water, Gas, and Steam Pipe, Wrought Iron. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

Shaw's accurate and U. S. Standard Mercury Gauges, Steam, Vacuum, Hydraulic, and Test Gauges, &c., 915 Ridge Avenue, Philadelphia, Pa.

Solid Emery Vulcanite Wheels—The Solid Original, Emery Wheel—other kinds imitations and inferior. Caution—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 31 and 33 Park Row, New York.

Models for Inventors. H. B. Morris, Ithaca, N. Y.

M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 229 W. 27th St., N. Y.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 539 Water Street, New York.

Pat'd Graining Stencils—J. J. Callow, Cleveland, O.

Lathe Dogs, Expanding Mandrels, Steel Clamps, &c., for Macinalists. Manufactured by C. W. LeCount, So. Norwalk, Ct. Send for reduced Price List.

Driving Belts made to order, to accomplish work required. Send full particulars for prices to C. W. Army, 148 North Third St., Philadelphia, Pa.

"Dead Stroke" Power Hammers—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 25 per cent. Hall & Belden Co., Danbury, Ct.

Power & Foot Presses and all Fruit-can Tools. Ferracute Wks., Bridgeton, N. J. & C. Z. Mcay, Hall, Cent'l.

No. 3 Woodworth Planing, Tonguing, and Grooving Machine for Sale Cheap. Address Wm. M. Hawes, Fall River, Mass.

Steel Castings, from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for rolling and bending metals. A. Lyon, 479 Grand Street, New York.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Yacht and Stationary Engines, sizes 2, 4, 6 and 8 H. P. Best for price. N. W. Twiss, New Haven, Conn.

Shingle, Heading and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Wanted—On royalty, by a reliable house, some good practical invention in Cast Iron, Brass, or Machinery, to work as a specialty. Address Foundry, Station B, Philadelphia, Pa.

D. Frisbie & Co. manufacture the Friction Pulley—Captain—best in the world. New Haven, Conn.

The Best Sewing Machine in the world—Makes the Lock Stitch, the Chain Stitch, and Embroidery Stitch from two whole Spools. Agents wanted everywhere. G. L. Du Laney & Co., 344 Broadway, New York City.

Patent Scroll and Hand Saws, best and cheapest in use. Cordesman, Kagan & Co., Cincinnati, Ohio.

Chester Steel Castings Co. make castings twice as strong as malleable iron castings at about the same price. See their advertisement, page 269.

Notes & Queries.

F. P. will find directions for writing on glass on p. 203, vol. 33.—S. B. will find directions for dissolving mica on p. 241, vol. 32.—J. A. L., J. O. M., and T. B. will find directions for ebullizing wood on p. 50, vol. 33.—C. R. can calculate the horse power of his engine by the formula given on p. 33, vol. 33. As to speeds of pulleys, etc., see p. 180, vol. 26.—T. S. should galvanize his castings. See p. 315, vol. 33.—B. B. will find a description of an incubator on p. 277, vol. 33.—A. C. G. should use Indian ink for architectural drawing.—C. P. R. R. will find directions for making rubber stamps on p. 156, vol. 31.—C. H. will find a recipe for a depilatory on p. 183, vol. 34.—M., G. C. M., C. H. L., W. B., H. H., J. I., T. B. C., and many others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) C. B. W. says: 1. Why is it that there are so many more square inches in the smoke arch of a locomotive than there are in the flues, when the steam exhaust and petticoat pipe are in their places? A. To give the clinders a chance to fall in the smoke box. 2. Would there be the same draft to the locomotive if the arch only had the same square inches in it as there are in the flues when the draft is made by the exhaust steam? A. We think not.

(2) C. W. J. says: 1. My house is in the cottage style, one story high; the main body is 32x14 feet. The roof is a hipped roof, with pediment in front of main roof. The roof is perforated by two terra cotta flues. Would you advise the use of lightning rods? A. Yes. 2. What kind and size rods would insure safety? A. Use iron rods half an inch in diameter, and terminate them in the earth where it is constantly wet. Connect all the rods together at the top of the house and in the earth. Also connect lateral rods at the earth to insure good contact with the ground. 3. The roof around the terra cotta flues. What kind of cement or plaster would effectually stop the damage and annoyance? A. See p. 183, vol. 33.

(3) H. P. S. asks: 1. What is the hardest metal or composition for rollers, that will not rust or corrode by salt water or dampness? A. The new mixture of metals termed phosphor bronze. See p. 183, vol. 33. 2. What is the hardest and most durable metal to use for rollers, and what is the method of hardening? A. Steel, hardened as described on p. 51, vol. 30. 3. What is the cheapest method of turning or grinding chilled cast iron rollers or boxes? A. See p. 559, vol. II, SCIENTIFIC AMERICAN SUPPLEMENT.

(4) H. P. & S. say: We have one high pressure engine of 14 inches bore and 36 inches stroke, with the ordinary slide valve. It makes 48 revolutions per minute, driving our whole works with 45 lbs. of steam. Every time the engine exhausts, there is a drag to it, and a kind of a sucking noise which we cannot stop. The valve has got about ½ inch lead, and takes her steam alike at both ends, and the crank passes her centers easily. The slide valve sets square on its face and perfectly tight; we have tried it, and it will not leak a drop of water. How can we stop this drag on our exhaust? A. There is probably not enough steam lap on the valve to give a free exhaust, in which case the lead may be made ¾ inch.

(5) J. D. H. says: What is the cause of the long lines found cut in the piston of a steam engine as well as in the cylinder? A. Abrasion or cutting, from grit in the lubricant, bad fitting, or other cause.

(6) A. F. & Co. say: We are running an old fashioned 10x24 inches engine, with steam chest on top of cylinder. It cuts off the steam at 4 inches from the end of stroke, is making 112 revolutions per minute, and drives 2 runs of 4 feet stones, grinding 5 bushels wheat per hour, and driving the necessary machinery. We carry 60 lbs. of steam on a 4 x 12 feet tubular boiler. Intending some time to put in an extra run, can we increase the power of an engine by putting in a longer valve, so as to cut off the steam, say at ¾ stroke? We have ample room in steam chest and can lengthen stroke of valve both by the eccentric and the rod shaft. A. You would not increase the power by cutting off earlier in the stroke.

(7) M. J. T. asks: What metal is susceptible of the highest polish? A. Steel.

(8) N. E. L. says: 1. What is Mr. Corliss' improvement on the steam engine? A. Corliss connected the governor to cut-off valves placed close to the bore of the cylinder, and thus governed the engine by cutting off the steam earlier or later in the stroke, according as the amount of the load diminished or increased, and by this means effected a saving in fuel. 2. Was he the first man to use steam expansively? A. No. 3. What percentage does the Corliss save by placing the valves near the ends of the cylinders? A. This depends upon the length and size of the ports of which comparison is made. 4. What percentage of fuel ought I to save by an expansion valve? A. It depends upon the degree of expansion used and other circumstances. 5. I am going to take off my plain slide valve, give my eccentric a longer throw, add more lap to the valve, and let steam follow about one third. The engine is a 4 horse portable. We run two lathes, emery wheel, etc. A. A plain slide valve will give a very distorted action if given lap sufficient to cut off the steam at one third of the stroke as you propose. See p. 373, vol. 31.

(9) J. W. D. E. asks: If 50 lbs. tractive force will be sufficient to draw a certain load

along a level railway track at the rate of 5 miles per hour, what will be the increase of force necessary to draw the same load at an increased speed of 10 miles per hour? A. About 12 lbs. The power required will of course be more than twice as great, since there is an increased resistance to be overcome at a double rate of speed.

(10) H. A. H. says: 1. I have constructed a galvanic battery, but it will not work. I took a two gallon stone jar, and in the jar I put a zinc cylinder; inside of that I put a flower pot (for a porous cup) and inside of the flowerpot I put a piece of copper. I then attached a copper wire to the zinc cylinder, and one to the copper in the flower pot; then I made a solution of sulphate of copper and put it into the flower pot next to the copper, and a solution of common table salt and put it into the jar next to the zinc cylinder; then I connected the two wires at their other extremities, but I got no sign of electricity. Please let me know what is wrong. A. The battery you describe would produce a current, although not a very strong one. 2. Can I make Leyden jars out of glass beer bottles if I cut the necks off? A. Yes, by covering the inside and outside with tin-foil.

(11) W. H. J. asks: Will you please explain how a pair of car wheels get around a curve? A. argues that the inside wheel slips and the outside wheel slides. B. argues that only the inside wheel slips. C. argues that only the outside slides. Who is right? A. It might be possible for either action to occur in certain cases. Generally, on moderate curves, we think C's view is the most correct.

C. W. J. asks: How can I preserve guava and citron?—C. H. T. asks: Can you tell me of some way (other than by grinding or filing) by which the black caused by hardening can be removed from the steel, leaving the steel gray?—C. H. L. asks: How can I make a good flavoring for cigars?—P. S. K. asks: How can I make Belfast ginger ale?

COMMUNICATIONS RECEIVED.

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

On Rambling Notes. By L.
On Disinfectants, etc. By H. J.
On a Point on a Connecting Rod. By W. H. P.
On a Solar Phenomenon. By S. J. W.
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On Workmen and their Instructors. By S.
On Patents. By G. W. H.

Also inquiries and answers from the following:
V.—E. A. D.—A. J. C.—C. C. R.—C. C.—W. C. F.—J. R. N.—W. W.—J. B. O.

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.

Hundreds of inquiries analogous to the following are sent: "Who makes rain gages? Who sells the improved hydraulic ram, described on p. 259, vol. 31? Who sells ice-making machinery? Who sells propellers suitable for boats 12 feet long? Who sells machines for bending, punching, and rounding band iron? Who sells oilstones? Who sells surface butt hinges, suitable for cupboard doors? Who sells small knife blades? Who sells matches for use in the open air? Who sells folding tents?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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September 19, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are renewed patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Mann & Co., 27 Park Row, New York city.

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9,498.—TWIN HOLDER.—W. Griscom, Reading, Pa.
9,499.—TYPES.—J. Gildenstein, Roselle, N. J.
9,500.—CARPETS.—E. Guiraud, New York city.

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Gravity of Liquids, Solids, Air, and Gases; Gunpow-
der—Pressure, Heat, and Horse Power of; Copying Ink,
to Make; Heat, its mechanical equivalent explained;
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ning and Lightning Rods—valuable information. Value
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Vol. XXXV.—No. 18.
[NEW SERIES.]

NEW YORK, OCTOBER 28, 1876.

\$3.20 per Annum.
[POSTAGE PREPAID.]

IMPROVED MACHINE FOR STRINGING TOBACCO LEAVES.

We illustrate herewith a new foot power apparatus by which tobacco leaves can be rapidly pushed upon a string, and also along a rod or wire to which the cord serves to secure them. The arrangement is such that the leaves can be strung as rapidly as two persons can present them from opposite sides in front of the needle.

The needle, A, which is shown detached in the foreground, rests in notches on inclined projections above the table, with its point projecting over a cavity, B, in the bed. It is confined against being pushed back by the shoulders formed upon it as shown. A spring, C, bears on the point, and a spring, D, on the body, of the needle between the inclined projections. The string is attached to the head and also to the rod, E, the further end of the latter being secured in a standard not exhibited in the engraving. F is a fork, pushed between which and the point of the needle the leaves are placed. By means of the treadle and crank mechanism beneath the table, the pusher is caused to move forward, thus forcing the leaves upon the needle, which is lifted by the leaves as they pass out of the notches in which it rests. The springs then force the needle back into the notches; and the pusher, continuing its motion, carries the leaves upon the string, then descends, passes back under the table, and resumes its original position, ready to push forward a new supply of leaves. By presenting the leaves to the pusher, alternately from opposite sides, they are made to hang on each side of the rod until the string is full. The end of the cord is then fastened to the rod, the latter with its load is removed, and a new rod and string are adjusted.

The device is simple and labor-saving, and will doubtless greatly facilitate work where extensive crops of tobacco are to be prepared for drying, etc.

Patented through the Scientific American Patent Agency, August 29, 1876. For further information relative to sale of patent or regarding royalties, address the inventor, Mr. Louis Strasser, 317 South Washington avenue, Columbus, O.

IMPROVED MILLING ATTACHMENT FOR LATHES.

We illustrate herewith an ingenious invention, the object of which is to increase the capabilities of the lathe in order

that that tool may be adapted to the work of a milling machine. There are many shops where the last named implement would be of much assistance, but yet is not so frequently required as to warrant its purchase. In such cases the present device offers both an economical and a convenient mode of supplying the need; and as it includes an adjustable bed plate, it besides furnishes an effective adjunct to the lathe itself.

The apparatus consists of a swinging frame, A, having

held by a clamp screw in the slot of the standard. The tangent screw admits of nice adjustment of the frame, and defines the position of the latter and that of the milling cutter at the exact height required.

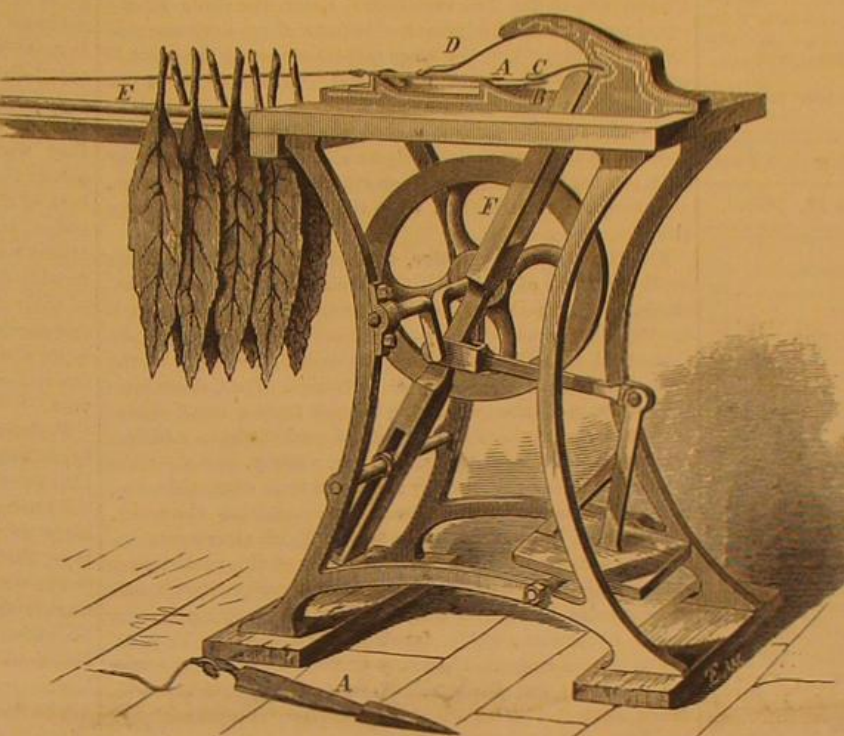
The frame carries the arbor, D, to which the cutter is applied, the arbor being retained at one end in a bearing in the frame, and at the other by a pointed screw center rigidly held in position by a jam nut. It is revolved by a gear wheel at its end, engaging with a gear wheel of the lathe mandrel.

Work is fed to the cutter by means of the solid bed plate and feed screw shown. The plate moves on a guide plate clamped to the lathe carriage, and is adjustable to any angle up to 45°.

The automatic feed of the lathe and the range afforded in the direction of the lathe bed facilitate the milling-off of plane surfaces, and enable the lathe to do the work of a small planer. Instead of using the bed plate for small work, a suitable vise or work holder may be clamped to the tool post. Several devices for this purpose are known to mechanics; but when this attachment is used, they may be made more simple and substantial, as the height of the cutter is varied and not that of the work.

By withdrawing the back center of the lathe, and relaxing the clamping nut beneath the bed, the whole milling arrangement may be removed at once. The device is now operation at the Centennial Exposition, in Machinery Hall, section B 4, column 28.

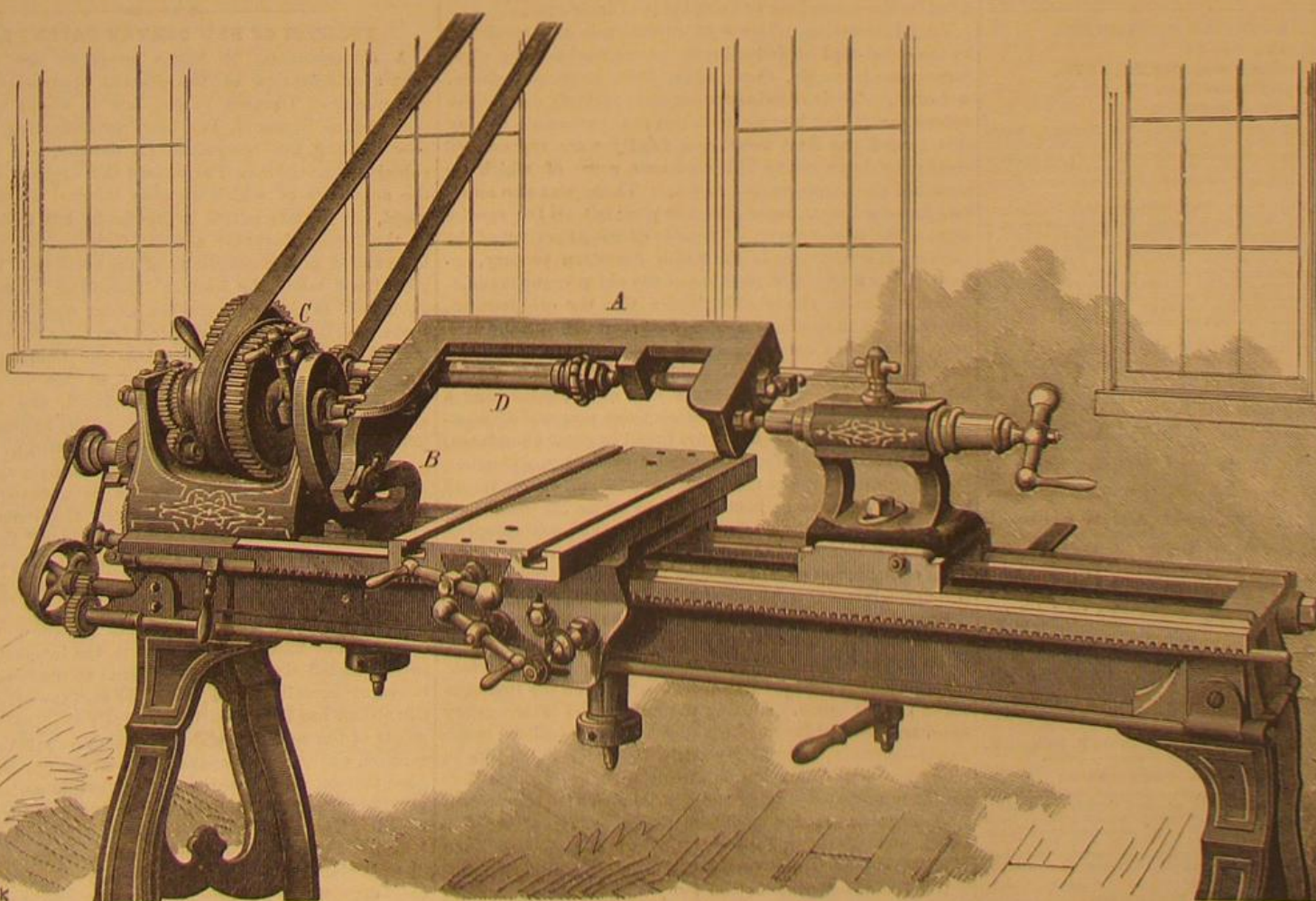
Patented through the Scientific American Patent Agency, August 29, 1876. For further particulars relative to sale of rights or of patent, address the inventor, Mr. Wm. Main, Jr., Columbia, S. C.



STRASSER'S MACHINE FOR STRINGING TOBACCO LEAVES.

rectangular sides, which is applied to the lathe centers and adjusted by means of a slotted arc-shaped standard, B. The latter is secured to the lathe shears by a base part fitted to the lathe and a clamping arrangement. It is removed from the machine with the milling attachment when not required for use. The extension of one arm of the swinging frame is clamped to the stand by a set screw, and is secured at the desired angle by the tangent screw, C, that turns in a socket

INVENTIVE HONORS.—A medal of the value of \$100 has been founded by Mr. Benjamin Shaw, of which the Society of Arts, London, has accepted the trusteeship. It is to be awarded every fifth year "for any discovery, invention, or newly devised method for obviating or materially diminishing any risk to life, limb, or health, incidental to any industrial occupation, and not previously capable of being so obviated or diminished by any known and available means." The first award will be in May, 1877.



MAIN'S MILLING ATTACHMENT FOR LATHES.

Scientific American.

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NEW YORK, SATURDAY, OCTOBER 28, 1876.

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With 49 Illustrations.

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SOME EXTINCT AMERICAN ANIMALS.

When the theory of evolution began to displace the old theory of specific creation, its opponents were wont to ask triumphantly for missing links. If species are the result of gradual development by progressive variation, they said, we ought to find an abundance of intermediate forms: where are they?

The advocates of evolution could only reply: They will appear when sought for. Darwin even ventured the prophecy that in course of time links would be found connecting the extremely specialized one-toed horse with the normal four and five toed mammals. The readers of the SCIENTIFIC AMERICAN know how completely the prophecy has been fulfilled in the numerous and increasingly specialized horse-like creatures which roamed over our Western plains during the tertiary period of geology. At the beginning of the period the four-toed orhippus was most like the horse that was to be, though it exhibited many unhorselike characteristics. From that time down to the present the chain of development is complete, the precursors of the horse steadily growing more and more horselike in head, and foot, and general structure of body and limb. In the middle tertiary, the meshippus had but three toes, a slender splint of bone being the only vestige of the lost toe; and in the mihippus the splint had vanished. Later the three nearly equal toes of the mihippus had become three very unequal toes in the hipparion, the large middle toe being the main if not the entire support of the animal. At the close of the period, the prevailing form was a true horse, in which the dwindled and useless side toes of the hipparion had ceased to exist as toes, appearing only as slender splints under the skin. In the modern horse these splints are sometimes seen, attesting its relationship with the horses of prehistoric times.

Similar, if not as positive, evidence of evolution is borne by the remains of tapirs, rhinoceroses, and other hoofed animals. In eocene times the most prominent of the unequal-toed ungulates were the hyrachyus and the paleosyops, the former allied to the lophiodons and tapirs, the latter to the paleotheriums of the European tertiary. Both these families embraced animals varying in size from a small rhinoceros to a peccary. In the miocene period, these families attained a great development in form, variety, and size; the group became more distinctly separated from each other, and some of them possessed remarkably specialized character. There were, however, no true tapirs, which afterwards became so numerous. The ascendant forms of this period were rhinocerotid, represented by the diceratherium, with its pair of horns side by side on the nose, and the very interesting genus hyracodon, which furnishes a connecting link between the paleotheroid animals of the eocene and the true rhinoceros of the pliocene. The miocene period also produced several species of a more perfect rhinoceros, still hornless. But more remarkable than any of these, indeed in some respects the most remarkable of all the animals brought to light in the strata of the West, were a number of species of grotesque appearance and gigantic size, resembling the existing rhinoceros in general appearance, but larger, some of them approaching nearer to the elephant in size and length of limb. They have been named titanotheriums, brontotheriums, and sphenorodons, and appear to have died out during the miocene epoch. While they lived they must have played the part of the then extinct uimatherium of the eocene (of which more directly), and that afterwards filled by the mastodons and elephants of later ages.

Very interesting evidence of evolution is also furnished by the equal-toed hoofed animals, represented now by pigs, hippopotami, camels, chevrotains, deer, antelopes, sheep, and oxen. Their remains appear but sparingly during the eocene period, but become abundant in the miocene. During this period the first mentioned family were represented chiefly by huge swine-like creatures, some of which approached the hippopotamus in size. There was also an allied four-toed form, more like true pigs; but all the species were of the peccary type. The sole existing survivor of the form on this continent is the South American peccary, apparently an unmodified remnant of the old miocene fauna.

A much more remarkable family was the oreodontidae, which began in the later eocene, extended through the miocene, when they swarmed enormously, dying out in the early pliocene. In nearly all points of structure, they were intermediate between ruminants and swine, furnishing a complete line of transition between those now widely separated groups. Their remains are found in great abundance, both in species and individuals; and a gradual modification, corresponding with the chronological position, can be traced from the earlier, more generalized forms to the latest and most specialized: thus affording one of the most complete chains of evidence yet found in favor of a progressive alteration of form, not only of specific but of generic importance, through advancing ages.

Exceedingly suggestive, too, is the history of the camelidae as exhibited in our tertiary strata. Here was apparently the original home of this singular group, now represented only by the llamas of South America, and the two camels of the old world. During the middle and later tertiary ages, transitional forms from the more generalized ruminants—animals increasingly camel-like and llama-like in character—were abundant in North America, whence they probably migrated during the glacial epoch to the present homes of the existing members of the family, along with the horses, tapirs, and peccaries, which disappeared from this country about that time.

Not less interesting is the story told by the remains of those unique eocene monsters to which the names titanotherium, uimatherium, dinocera, loxolophodon, and eobasilus

have been given: huge creatures intermediate between the orders represented by the rhinoceros and the elephant. Professor Flower compares them to broken piers of the bridge by which the gulf, that now so completely divides the orders of the perissodactyle ungulates and the proboscidea, may have been passed over. They were all elephant-like in bulk and general appearance, yet presented a combination of characters which made them unlike anything elsewhere known. Their feet were five-toed, their legs straight and massive; their necks longer than the elephant's, and their small-brained, narrow heads much more like the rhinoceros's than the elephant's. But their distinguished peculiarity was their frontal armament of three pairs of horns, which, with their enormous size and strength, must have made them formidable indeed. Their end is yet a mystery. It has been suggested that at the close of the eocene period they may have migrated to Asia to lay the foundation of that family which first appears in the old world under the more familiar forms of the typical proboscideans—the elephants, mastodons, and mammoths. None of these appear in America earlier than the pleiocene period, a long time after they had become abundant in the old world.

Among the carnivora which preyed upon the abundant herbivorous fauna of the great plains, forests, and lake regions of the tertiary ages, not a few furnish extremely cogent evidence of specific evolution. There were among them fierce creatures, larger than wolves (synaptotherium and mesonyx) which presented such a combination of characters that it is impossible to rank them with either of the existing families of the order to which they belong. In some respects they were like dogs, in others they were bear-like; in still others they were more generalized than any existing members of the order. Then there were several species of hyaenodon, some larger than any of the European forms, and others no larger than a fox: "the last survivors of a group notably differing from any now known." In the character of their skulls they stand intermediate between wolves and opossums. In the earlier periods, still more generalized types abounded, some of them combining the generic characteristics of half a dozen of our specialized modern carnivora.

Perhaps the most remarkable of these comprehensive types was the tillodontia, which seem to have combined the characteristics of several distinct groups, the carnivores, the hoofed animals, and the rodents. Some of them were as large as the tapir. Their molar teeth were of the ungulate type, their canines small, their incisors rodent-like. Their heads were bear-like, their general structure like that of the ungulates, their feet plantigrade. Two distinct forms abounded: one in which the incisors grew from persistent pulps, like the beaver's, the other having all the teeth rootless.

The dominant types of tertiary flesh eaters, however, were various modifications of felidae, fierce cats, some of them surpassing our modern lions and tigers in size and strength. Chief among them in the miocene age were the saber-toothed tigers, which seem to have overrun the whole world about that time, and to have lingered in some parts until the human period. It is one of the puzzles of paleontology to account for the extinction of this highly specialized type, apparently the fittest of all the cat family to win in the struggle for existence. Happily for man they did not survive in force, to contest his progress toward the mastery of the earth.

PROSPECT OF NEW GERMAN PATENT LAWS.

A correspondent in Berlin sends us the intelligence that a modification of the present oppressive and illiberal system of German patent law is about to be made: that Prince Bismarck has been investigating the code as now existing, has recognized its defects, and will shortly submit to the German Parliament the draft of a new law, the substance of which we give below. As matters now stand, the German patent is practically but little safeguard to the foreign inventor against German piracy, a fact we have stated in a multiplicity of connections. The government itself takes the lead in "adopting" foreign devices submitted to its examination under applications for patents, and it protects its people when they follow its example. We need go no further than the Centennial Exposition to find a striking instance of this in the Krupp guns, wherein is used the Broadwell gas check ring, an American invention, and a necessary appendage to all breech-loading cannon. This was submitted to the German government for trial, and was unblushingly appropriated, and the inventor virtually told to go about his business. The invention is styled the Broadwell ring even in German official reports. Krupp likewise "adopted" the invention, and has used it on thousands of guns without paying the inventor a cent. The same has been the case notably with other American military inventions.

Of course it needs no argument to show that such a course is not merely detrimental to the interest of foreign inventors, but also highly prejudicial to the best interests of Germany herself; and of this latter fact the astute Imperial Chancellor has doubtless become fully apprised. The main points of the new law which he suggests are that every invention, excepting, of course, such as are opposed to law or good morals, may be patented. Inventors are not bound to give licences except where such are demanded for the public benefit. The specification must be definite, must be published at a certain time after application, and must embody distinct claims. The first applicant is considered the inventor, disputes as to originality are to be settled by the courts, and, in obtaining patents, foreigners are placed on the same footing as Germans, with the exception, however

that the former must appoint an attorney or representative in Germany. Patents may be declared void if insufficiently worked in the German Empire. It is considered a proof of such insufficiency if the articles patented are imported into Germany after a qualified person has offered to work the patent within the Empire. All such patents are to be forfeited if the proprietors allow importation without interfering, provided the laws of the respective patentee's native country contain similar ordinances (France, etc.). In all other respects, there is no special proof of working necessary. Patents are to last fifteen years, and in certain cases extensions may be had. Progressive taxes are to be levied. Prior publication prevents the grant of a patent, the patent right is transferable by deed or will, divided or undivided. A special court is to be provided for patent suits. Patent objects are to be marked, as under the American law. Patents may be declared void if the invention is insufficiently specified, if the foreign patentee maintains no German representative, if taxes are not paid, or if the patent can be proved to have been void from the beginning. There are some other, minor provisions, but the above sufficiently indicate the scope and character of the law, which, so far as Americans are concerned, is but little improvement on the present system. Of course the complete text is necessary before a just opinion of the provisions as a whole can be reached, and we should prefer some experience in its working before hazarding judgment as to its fairness and efficacy as regards foreign inventors. The clauses which require inventors to "give licenses when demanded for the public benefit," those relating to working in the Empire, and the offer by "a qualified person" to do so in the event of the non-compliance of the inventor, seem to open the way to wide constructions adverse to foreigners, and virtually to a continuance of the present injustice. The letter of the law may, it is true, change; but when such constructions are possible, and not only this, but, as past experience shows, have been the rule in Germany, it is not unreasonable to believe that those who interpret the law will be guided therein by the light of precedents.

PROGRESS OF THE MISSISSIPPI RIVER JETTIES.

We have held so firm an opinion that a triumphant success awaited the carrying out of Captain Eads' plans, for opening the Mississippi river to the commerce of the world, that to read the engineer's reports of the splendid progress of the work is but to learn of the fulfilment of confident expectations. The latter report, dated August 18, is now before us, and the results noted must certainly be gratifying to the whole country. The channel between the jetties, we are told, is constantly increasing, and the jetties themselves are built up above mean low tide, and for a great length above average high tide. The last survey, made July 27, shows a channel extending down 11,800 feet from the upper end of the jetties, and within only 250 feet of the deep waters of the Gulf, having an average width of about 350 feet, in which all soundings are 20 feet or more in depth. The line of deepest soundings through the length of 2½ miles averaged over 26 feet, and many single soundings showed over 40 feet. Some idea of the progress of the erosion going on between the jetties may be inferred from the fact that the 20 feet channel, existing on June 17, had increased in average width nearly 100 feet throughout its entire length in the forty days between that date and the last survey.

Captain Eads reviews, in some detail, various objections which the opponents of his project have urged, and devotes himself more especially to the assertion that the earth washed out of the channel would merely form a new bar outside the jetties, and thus render access as difficult as ever. To settle this matter, he had soundings made in radial lines from the end of the jetties; and comparing the results thus obtained with those gained from a like series of soundings made in 1875, he finds that, instead of a bar being formed, there has been actually excavated, out of an area 1,100 feet square immediately in front of the jetties (which area must first be covered with deposit before a re-formation of a bar can occur) a mass of earth equal to 68,400 wagon loads. And this aggregate deepening has occurred while nearly 3,000,000 cubic yards of earth have been taken up, from the bar between the jetties, by the river current, in excess of the ordinary burden of sediment, and transported over this area out into the Gulf of Mexico. If the mass had been deposited over the area mentioned, it would have covered the space to the depth of about 18 feet. In fine, it is conclusively proved that a general deepening has occurred in 490,000 square yards of the area in front of the jetties, comprising the outer slope of the bar and the track of the river discharge, and thus the report of bar advance and shoaling in front of the jetties is shown to be without any real foundation. Captain Eads admits that this favorable phenomenon of deepening immediately in front of the jetties was unexpected to all the advocates of his system, and he ascribes it to the sea current which is induced by the prevailing winds, which blow almost constantly from between the northeast and southeast. The current resulting is driven westwardly beneath the river discharge, and excavates more room for itself as the volume from the jetties becomes gradually stronger. Captain Eads reports in conclusion

"In seventeen months after the passage of the act, and within fourteen months from the commencement of the work, the jetties have solved the problem presented at the mouth of the river. In their unfinished condition, they have withstood with but trifling injury two very severe storms, one surpassing in violence any known in the locality for many years; they have demonstrated the entire ability of the delta formation safely to sustain the works necessary to

control the river discharge; they have not been overturned by mud lumps, nor swallowed up in quicksands, nor undermined by the river current; and although largely over 3,000,000 cubic yards of earth have been swept out from between them into the Gulf, and the channel across the bar has been deepened from eight or nine to twenty-one feet, no evidences of a re-formation of the bar have yet to justify the belief that any extension of them will be necessary."

STEAM ENGINE SLIDE VALVES.

Some of our correspondents seem to have a difficulty in deciding as to the comparative merits of engines with single slide valves, and engines with separate cut-off valves. Take the following letter as a specimen:

"Can you explain clearly and definitely the difference in action between an engine with a single slide valve and one having two slide valves, one being a cut-off valve, there being a throttle in the steam pipe? And what are the advantages of the more modern cut-off engines, in which the governor acts upon the cut-off valve directly? I cannot find the information in any book, and none of the men in our shop seem to have precise information upon it."

If, with a single slide valve, sufficient steam lap is given to the valve to enable it to cut off the steam earlier than when the piston has traveled about three quarters of its stroke, the exhaust becomes cramped at the cylinder exhaust port, as explained in volume XXXII, page 101. Hence, to economize fuel by using the steam expansively during a greater portion of the stroke, the cut-off valves were added; and at the same time, to avoid the loss of steam due to long steam passages, the latter were placed at the ends instead of in the middle of the steam chest. This necessitated the employment of two steam valves and two cut-off valves, it being considered that the power required to operate the valves was more than compensated for by the steam saved by reason of the short ports.

The placing of the throttle valve in the steam pipe had the following defects: In the first place, the action of a governor takes place after the error which it is intended to remedy has actually occurred: or, in other words, the speed of the engine must be greater than it is intended to be before the governor balls will rise and correct the evil. So that there is an element of time between the acceleration of the speed of the engine and the diminution of the steam supply by the action of the governor and throttle valve. Now in order that the initial pressure of the steam supplied to the cylinder shall be as near that of the boiler as possible, a supply of steam is provided close to the cylinder, that is to say, in the steam chest; and when the engine is running at her proper speed, the pressure of this steam approximates to that in the boiler; and if the engine speed increases and the governor closes to a corresponding degree the throttle valve, there is nevertheless a supply of steam at full pressure which has passed the throttle, and is already in the steam chest; and its action is, to a great extent, to offset the effort of the governor.

Secondly, the throttle valve, by reducing, at the necessary times, the pressure of the steam in the steam chest, correspondingly reduces its temperature, inducing in the steam chest a certain amount of condensation of the re-entering full pressure steam, admitted when the throttle valve reopens wide. When, however, the governor is attached to the cut-off valve direct, the pressure (and temperature) of the steam in the steam chest is not affected by the governor, and continues, therefore, to be nearly that of the boiler. The advantage due to this will perhaps be more readily perceived if we suppose that the throttle valve is the steam pipe, and that the engine load having suddenly lightened, the throttle partly closes, thus reducing the pressure of the steam in the steam chest and cylinder. If, then, the engine load suddenly augments, and the throttle opens wide, the inflowing steam is required to restore the pressure in the chest before it can restore it in the cylinder. In other words, the space requiring its steam pressure to be increased is the contents of the steam chest as well as of that part of the cylinder in open communication with the steam chest.

The action of a governor attached directly to the cut-off valve is that, so soon as the engine load lightens, the supply of steam to the engine cylinder is lessened by cutting it off earlier in the stroke; and there is hence a direct relation existing, at all times, between the engine duty and the consumption of steam, the engine speed being reduced by the extra degree of expansion employed, instead of by withdrawing the steam. In addition to these advantages, most of the modern cut-off devices are given a motion which opens and closes the steam ports very suddenly, inducing a greater initial pressure of steam in the cylinder and obtaining a more sharply defined point of cut-off.

MORE CENTENNIAL AWARDS.

Another lengthy list of Centennial awards has been published, and the New York Times has still better ground for its witty suggestion that people will before long begin to seek for exhibitors who did not receive honors, under the idea that the true mark of distinction lies in failing to obtain any judicial notice whatever. Meanwhile it is amusing to notice the efforts which many of the successful exhibitors, and most especially the sewing machine and piano men, are making to convince the public that each and every one of them obtained the first and best and highest premium. Four piano firms are lavishly advertising the fact, and reinforcing their assertions with extracts from the judges' reports, which quotations, when considered together, show that the judges avoided an obvious dilemma by characterizing all the pianos as excellent, as doubtless they were, and leaving the rival makers to wrangle over their grammars and dictionaries in determining the exact comparative significance of the high sounding adjectives employed. Of

course (and every one who has taken the trouble to comprehend intelligently the system of awards knows it) there are no "first premiums," and it is only uselessly to infer ignorance on the part of the public to blazon forth any claim to such. The regulations of the Centennial Commission on the subject are as follows: "Fourth: Reports and awards shall be based upon inherent and comparative merit. The elements of merit shall be held to include considerations relating to originality, invention, discovery, utility, quality, skill, workmanship, fitness for the purpose intended, adaptation to public wants, economy, and cost. Fifth: Each report will be delivered to the Centennial Commission as soon as completed for final award and publication. Sixth: Awards will finally be decreed by the United States Centennial Commission, and will consist of a diploma with a uniform bronze medal and a special report of the judges on the subject of the award."

The cardinal object of the system is to avoid gradation. The judges simply write reports on exhibits which they deem commendable, and the Centennial Commission thereupon decides which out of the exhibits so reported upon are entitled to the medal and diploma. From the length of the lists, it is safe to believe that few if any of the objects commended by the judges were denied the distinction; and inquiry among several exhibitors in this vicinity reveals the further fact that, in most cases, those who did not receive judicial notice and a report owe it to their own neglect and misapprehension in not entering for competition, or in failing to send in the required description to the judges, or in some other wise not complying with the regulations of the Exposition.

We do not think that any one will regard the medals and diplomas as of any especial importance. Some system of the kind had to be devised, else exhibitors would be dissatisfied at being denied their usual stimulus. The defects of the old anonymous jury system, with its multifarious gold and silver medals, are well known, and the present plan was adopted as a better substitute. It gives everybody a premium, and that is excellent, and likely to cause universal gratification. The real distinction, however, lies in the reports; and when an exhibitor receives a document signed by such experts as Dr. John Anderson, or Professor Reuleaux, or Dr. Nordenskjöld, or Captain Eads, all of whom are judges besides many other eminent gentlemen, pointing out the merits of his device, showing wherein it excels, and thus lending the weight of their high authority in his support, then he has something worth any number of meaningless medals; and if he fails to publish that report, and to advertise the fact that he has received it, and the object he received it for, over the whole land, he simply neglects his best interests and throws away the greatest benefit which the Centennial Exposition can secure to him. And this we strongly advise our readers to do: Do not claim "first premiums," for that is nonsense; but procure a copy of the report (and every exhibitor is legally entitled to that), and publish it along with such a description of the invention that the public may see what has been accomplished, and what the accomplishment has earned.

We give below some further names of manufacturers and inventors well known to our readers, who have received favorable reports and awards: H. W. Johns, for asbestos and its adaptations to roofing, paint making, engine packing, boiler covering, cement, etc.; Dixon Crucible Company for graphitic crucibles; Morris, Tasker & Co., gas works machinery; Charles Pratt & Co., petroleum products; General M. C. Meigs, for hydroelectric light; Odorless Excavating Company, for cesspool cleaning machine; W. D. Andrews & Brother, for centrifugal pumps; Lathrop Anti-Friction Company, for lubricant; Jerome Wheelock for automatic cut-off engine; George B. Brayton, for hydrocarbon engine; and Professor R. H. Thurston, for metal-testing machine.

A Remarkable Fish Dinner.

The fish culturists who have recently been in session at the Centennial Exposition treated themselves, during their stay in Philadelphia, to a fish dinner, which is certainly extraordinary and unique in its way. The bill of fare embraced fifty-eight different kinds of fish, and in its entirety is much too long for publication here. Some of the delicacies, however, are remarkable. Under the head of *hors d'œuvres froids*, (the menu, by the way, is organized with the utmost elaboration) we find Norwegian pluck fish, Portuguese conger eel, and Spanish conger eel with tomatoes, Turkish botargos or mullet roes, Japanese shake or dried salmon, crayfish from the Cape of Good Hope, French tunny fish, Chinese white and black shark fins, Alaskan oolachans, Portuguese sword fish and squid, Russian caviar, Chinese dried fish maws, and, most astonishing of all, "desiccated octopus eggs." Noted scientists are honored by having their names applied to the various sauces. Thus we have *filet of English soles à la Buckland*, sheepheads, Agassiz sauce, aspic of eels *à la Huxley*, and *blague* of lobster, Seth Green style. It was a memorable feast, and taxed the culinary skill of the cooks at the Centennial to the utmost. One particular dish seems to have puzzled even the most ingenious chefs, and that was kanten (Japanese seaweed) *à la Sekizawa Akeio*. The aid of the Japanese cook in the employ of the Japanese Commission was at last invoked, and he proved equal to its toothsome preparation.

AN agricultural society in Massachusetts, desiring to encourage tree planting and the re-forestation of poor lands in that State, have offered prizes for the best plantations of larch, pine, ash, and other trees suited to different localities and soils. The prizes range in amount from \$400 to \$1000, and special instructions are published to guide competitors.

MUSICAL BUILDING BLOCKS.

An ingenious method for teaching music in a graphic manner has been patented by Mr. Herman Eckhardt, of Columbus, Ohio, through the Scientific American Patent Agency, September 5, 1876. It is a toy or game, by which almost any piece of music of a certain number of bars may be set up to be played.

In the engraving, A, Fig. 1, represents a clef block, that is equal in length to the height of the staff and the added spaces above and below the staff. The clef block, A, contains the G clef, with the lines and spaces numbered, together with the names of the notes upon the lines and spaces, and other information, on one side, and the bass clef, etc., on the other side. The clef block, A, also forms the rest or support, against which the other blocks are placed. The different musical notes, rests, characters, and signs are placed on blocks of varying sizes, proportioned to the duration of the same—the cubical blocks, B, containing whole and half notes, and whole and half rests, on lines and spaces; the semi-cubical blocks, C, quarter notes and rests on lines and spaces; and the quarter blocks, D, eighth and sixteenth notes and rests on lines and spaces, and all the other musical characters, as sharps, flats, naturals, dots, etc. The blocks, B C D, are provided with black edge lines, α , that form the lines of the staff in setting up the music, some of the sides remaining without signs or edge lines, to serve to fill up the spaces above and below the staff. The measures are indicated by means of thin strips, D', Fig. 2, of black or other colored wood, that are interposed between the blocks to form the division of the bars. A number of measure strips, B, are provided, in proportion to the number of blocks and bars that may be set up with the same. Any piece of music may be readily set up by selecting the required notes, rests, and sign blocks, and filling up with the remaining blocks, separating the blocks by the measure strips, in the manner indicated.

A New Safety Explosive Composition.

Messrs. L. de Soulages and R. Cahuc, of Toulouse, France, have patented through the Scientific American Patent Agency, September 19, 1876, a new blasting powder, which is claimed to produce a dynamical effect superior to the common mining powders and to dynamite, while it combines the advantages of cheapness and non-explosibility in the open air, with a reduced production of smoke and injurious gases in its explosion, leaving hardly any trace or residue of solid deposit of ashes in the bore hole. It consists of nitrate of potash or equivalent salts, sulphur, and soot or lampblack, combined with tanner's bark, sawdust, or similar separating ingredients, ground and mixed in suitable proportions. The compound is then mingled with a solution of sulphate of iron, and boiled until the mass becomes entirely liquid, with the parts so combined as to form a uniform black paste. This, when dried, produces a powder of a blackish color, and of a density of about 0.6. It may be stored for a considerable length of time without undergoing the least alteration or deterioration.

In the atmospheric air the powder takes fire and burns like any other inflammable body brought in contact with an ignited body or a flame of sufficient intensity, producing no shock or explosion whatever. Neither atmospheric electricity, nor shocks of any kind, have any action on the powder, which explodes only when firmly tamped or compressed in the bore hole, and ignited, like the ordinary mining powder, by means of a mining fuse.

IMPROVED BALE HOOP TIGHTENER.

We have had several letters from cotton press owners and others, asking for an invention which will pull together the ends of cotton bale bands while the bale is in the press, so that when the pressure is removed the bale will not expand. The object sought, of course, is to save room and consequently the cost of storage and freight. The present invention is apparently in response to this demand. In order to strain the hook around the bale, the inventors employ a lever with a forked claw and a hook, H, the former to engage the hook, A, behind its shoulders, and the latter to engage in one of the holes of the part, E, and draw them together in the manner indicated in the engraving. The hook is connected to the lever, so that it can be shifted toward and from the claw end as the resistance varies. This connection is preferably made by a yoked end of the hook, in which the lever is slipped, so that it drops into the notches, K, to be held the required distance from the end.

This device was patented through the Scientific American Patent Agency, September 5, 1876, by Messrs. Thomas C. Knowles and James P. Derden, of Vienna, La.

Spontaneous Combustion of Charcoal.

The late Mr. Braidwood, superintendent of the London Fire Brigade, England, remarks that lampblack and charcoal, when the smallest quantity of oil gains access to them, are more inflammable than sawdust and the vegetable and animal textiles, and should not be admitted among ships' stores.

The kinds of wood generally used for the manufacture of charcoal for gunpowder are the black dogwood, the willow, and the alder. These varieties are all well adapted for the purpose, though for the best brands of sporting powder the dogwood is said to be preferable. The wood is converted into charcoal by heating it in iron cylinders. After the charcoal is removed from these vessels, it is placed in iron coolers provided with tightly fitting lids, and allowed to stand for some hours until quite cool. It is then sent to the mill to be ground, and is afterwards mixed with the other ingredients for gunpowder. With reference now to this process, Professor F. Hargreaves vouches that there are many instances recorded where the charcoal has taken fire

by apothecaries for tooth powder, the charcoal being wrapped in white paper, and placed it on top of the gunpowder that was being dried upon the top of the stove. Having occasion to go out, I took off the paper of charcoal and laid it on the table. When I came back, in about twenty minutes, I observed the paper smoking. The charcoal was completely consumed. During all this time the gunpowder remained on the stove unexploded.

"My next observation was this: While at work in my laboratory, I had occasion to use a piece of charcoal for blow-pipe experiments. I went down into my cellar, and brought up a piece of light, fine, round charcoal suited for that purpose. It was damp. I laid it upon the top of a column stove to dry, directly beside a tin pan containing water, which was not boiling and never did boil there. I took the charcoal off the stove and laid it on the table. A short time afterwards, I discovered that it was on fire all through its mass. I laid it aside and it burned entirely to ashes. . . . I repeated the experiment again intentionally, watching it carefully, and with the same result." The explanation of the cases first quoted is not difficult to find. The charcoal possesses wonderful porosity and great power for occluding gases. This absorptive quality is supplemented by a species of selective power: in virtue of which, it absorbs oxygen with much more avidity and in much greater quantity than nitrogen. The enormous condensation which gas suffers by absorption into the pores of the charcoal is attended with the liberation of a quantity of sensible heat that is the equivalent of the work the atoms have accomplished: while simultaneously, the eminent non-conducting property of the charcoal hastens the period of active combustion by preventing the dissipation of the heat thus evolved, and concentrating it upon the porous mass.—*Polytechnic Review*.

Mineral and Vegetable Waxes.

Mineral waxes are hydrocarbons, often crystallizable, and differing from each other in their temperature of fusion. They are frequently derived from resinous trees buried in peat beds, and rarely from lignites or coal formations. The principal variety used industrially is ozokerit, sometimes called natural paraffin. It is less dense than water, of a waxy luster, and in one direction presents a conchoidal fracture, breaking into thin translucent scales. Its color is a brownish green by reflected light or yellowish brown or red by transmitted light. Powdered, it is a yellowish white. It is soft, flexible, cuts like wax, and softens at a low temperature. The odor is aromatic, and becomes more bituminous when the wax is rubbed. Friction also electrifies it negatively. It is fusible into a clear oily liquid, and burns with a bright flame. It is soluble entirely in turpentine and naphtha, more or less in ether, and slightly so in boiling alcohol, when the material separates in crystalline state on cooling. It is unattackable by sulphuric acid.

Ozokerit is found in the Caucasus, in England, and in Austria. In Moldavia, it is directly employed for illumination, being used in gas making, and in the manufacture of candles. A factory in Frankfort on the Oder prepares the material under the name of ceresine, and produces over 100,000 lbs. yearly. Ozokerit, in purified form, is largely used by perfumers and in pharmacy in place of beeswax, as it hinders medicaments from becoming rancid.

A similar substance, now but little employed, is hatchetin or mineral adipocere. This is of a yellowish white color, has a mother-of-pearl luster, is very soft and is of about the consistence of spermaceti. It is found in Belgium, Moravia, Bohemia, Wales, and England. It is scarcely attacked by nitric acid, but is completely carbonized by sulphuric acid. It is slightly soluble in boiling alcohol and in ether, leaving a viscous and inodorous residue.

Other mineral waxes are *neft-gil*, found in the island of Tschelekan in the Caspian Sea, near naphtha sources, and balkerite, from the vicinity of Lake Baikal. These are fossil waxes, or more probably bitumens, as are also kir and elaterite. The latter, often termed elastic bitumen or mineral caoutchouc, is of less density than water, of a blackish color, and is elastic like rubber. It has been found in this country, near Woodbury, Conn., and in many parts of Great Britain.

There is a large number of vegetable waxes but slightly known. Some are secreted by insects, which absorb the sap of various plants. Others are derived from the exudations of palm trees. The *Copernicia cerifera*, a Brazilian tree, bears leaves from the glands of which carnauba wax is obtained. The commerce in this material exceeds 2,000,000 lbs. yearly. In the Andes there exists the *cerozylon anticola*, which also yields a material known as palm wax.—*La Nature*.

On a high bluff near the Iowa river are some wonderful Indian mounds, with the remains of circular floors made of baked clay and the trunks of trees, covered with earth. Underneath the earth are human bones, copper axes with handles of polished horn and petrified wood, stone hammers, flint knives, and images of animals accurately carved and polished, made of a hard reddish stone.

Fig. 1

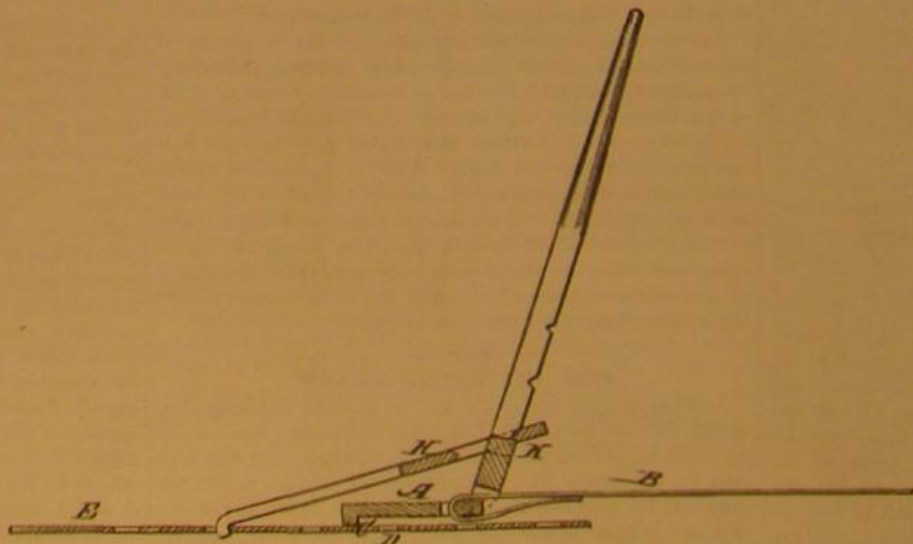


Fig. 2



ECKHARDT'S MUSICAL BUILDING BLOCKS.

the second day after grinding. With the process of this occurrence we are by this time quite familiar. The same observer, it appears, is also aware of the fact that the pulverization of the charcoal is not absolutely indispensable for such ignition to ensue, for he adds, at the conclusion of his remarks: "The absorption (namely, of oxygen) with sticks of charcoal is not so quick as with ground charcoal, and hence the spontaneous combustion of stick charcoal does not occur so often." Mr. Hatfield, in a paper containing "Observations on the Circumstances producing Ignition in Charcoal at Atmospheric Temperatures," published in the *Philosophical Magazine*, states the following: "If twenty or thirty hundred of charcoal, in a state of minute division, be put together in a heap, and left undisturbed, spontaneous combustion generally occurs." He records, in verification of this statement, the following instance: "A quantity of small charcoal was thrown into a heap that covered about ten feet square and four feet deep. In three days the temperature had increased to 90° Fah., although it was at first only 57°, that of the surrounding air. On the sixth



KNOWLES AND DERDEN'S BALE HOOP TIGHTENER.

day, it had risen to 150°; and on the seventh, combustion had commenced in several places."

Dr. C. T. Jackson, in a communication to the American Academy, gives the following piece of testimony corroborative of what has just preceded: "Three times," he remarks, "I have set fire to charcoal at temperatures below that of boiling water. My first experiment of observation was accidental. I was preparing, while at Bangor, Me., for a lecture, in which I had occasion to show an artificial volcano. I took a tray filled with gunpowder and laid it on the stove to dry. I then took a paper of pulverized charcoal, such as is sold

IMPROVED YARN REEL AND TESTER.

The necessity for close attention to the details of cost of manufacturing, both in the matter of stock and labor, has recently received much consideration. This is especially the case in the cotton and woolen manufacture. The two engravings published herewith exhibit very important means towards greater economy in the spinning of cotton and wool, beside keeping the manufacturer informed of the actual quality of the work produced.

Fig. 1

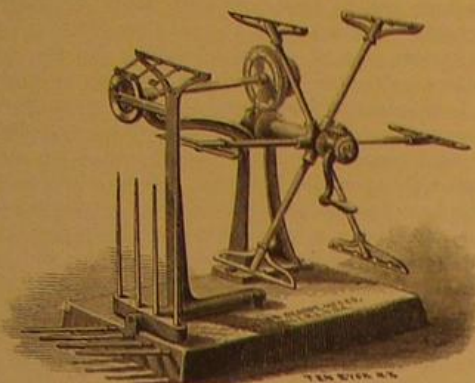


Fig. 1 shows an improved yarn reel of new design, particularly adapted for use in reeling fine cotton, linen, woolen, or worsted yarns. The reel is one and a half yards in circumference, and connects with a disk graduated into 120 parts, indicating the number of yards reeled from each spindle. An automatic feed motion lays the yarn flat upon the reel, securing accurate and uniform measurement, and consequently correct results as to stretch, strength, and numbering.

Fig. 2.

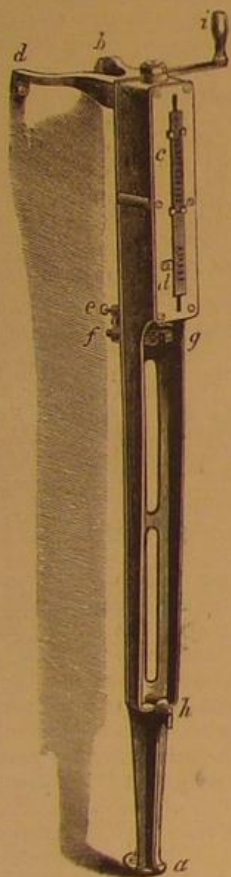
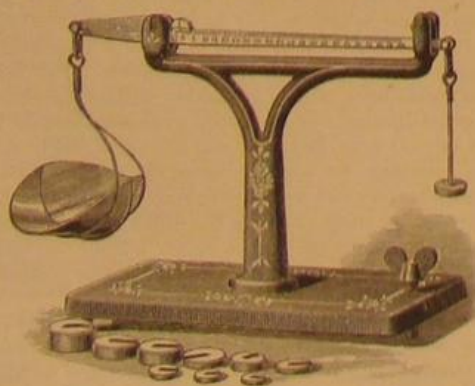


Fig. 2 exhibits a yarn tester, which is designed to test both the strength and stretch of yarns. A knot, or one seventh of a hank or skein, of yarn is first reeled and then removed from the reel and placed upon the pins, g and h. The crank, i, is then turned to the right until the yarn breaks. The index point, d, will then show the amount of stretch in inches and eighths, and the upper index, c, will give also the exact breaking weight in lbs. avoirdupois. The machine is adapted for a breaking weight of 100 lbs. or less, which generally includes any number of yarn above 20. If any number should exceed 100 lbs. in strength, it would be necessary to reel off only half of the amount mentioned above, which would equal 60 yards, and then multiply the weight by 2. The advantages resulting from the use of such a reel and tester will be at once appreciated by those familiar with this branch of production.

Further information can be obtained from the Brown & Sharpe Manufacturing Company, Providence, R. I., who are the inventors and makers.

SAMPLE-WEIGHING SCALE.

The sample-weighing scale illustrated herewith is designed to meet a want often felt where a large number of small articles or parts are to be computed, or large quantities are to be estimated from the weight of samples. One pound can be weighed by ten thousandths. Screws, samples



of paper, drugs, colors, etc., can be accurately weighed. It also answers for a postal scale. The finished parts are nickel plated, and the stand and base are neatly japanned and ornamented. The scoop is detached for convenience in use. Further particulars will be furnished by the Brown & Sharpe Manufacturing Company, Providence, R. I.

A SYSTEM of weather observations is now applied to the whole coast of Australia. All the stations are connected by telegraph

PATENT GAS HEATER.

The simple contrivance illustrated herewith at once explains and commends itself to those who require a ready means of heating and tempering small tools. It is intended to take the place of a forge in heating and tempering machinery and jewelers' small tools, beside being capable of use for domestic purposes, such as a nurse lamp, etc. A



piece of steel half an inch in diameter can be heated sufficiently to harden in about six minutes. It does not heat to a degree that will injure the quality of the steel, and tools heated by it will be tougher than when heated in a forge in the usual way. Darling, Brown, & Sharpe, Providence, R. I., are the makers of this article.

FISHHOOKS, JETTIES, AND MISCELLANEOUS DEVICES.

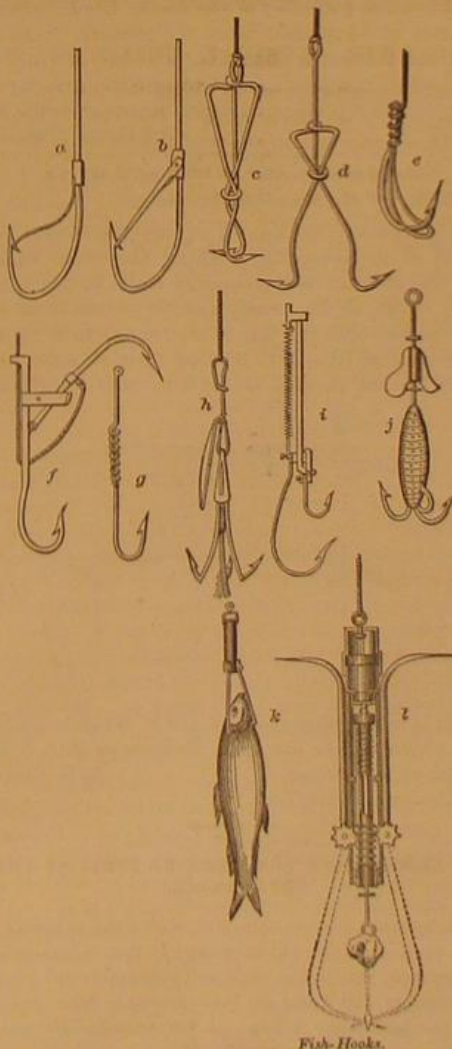
We select this week from Knight's "Mechanical Dictionary" a number of interesting engravings relating to subjects which it is scarcely possible to classify under any one general heading. In Fig. 1 is represented a number of ingenious

FISH HOOKS.

a and b are two forms of spring hook in which a mousing piece engages the barb. c and d are two positions of the same hook, one set and the other sprung. e is intended to give the hook a square presentation, and prevent glancing of the hook in striking. f has a tripping hook which strikes from above, and supplements the primary hook. g has a spiral spring shank. h has a spring hook attached to the snood, which affords the means of attaching a bait or other hook. i has an additional hook, which is sprung, and thus supplements the primary hook. j has spiral vanes, so as to revolve it when drawn through the water in trolling. k l shows two forms—on different scales—of a spring hook whose claws are thrown down upon the fish which tampers with the bait.

In making the hooks, straight wires of the proper size and length are flattened at one end, and the barb formed by a single blow with a chisel. The point having been sharpened, the proper curve or twist is given to the hook; the soft iron is then case-hardened, to give it the stiffness and elasticity of steel, by immersion in hot animal charcoal. The hooks

Fig. 1.



Fish Hooks.

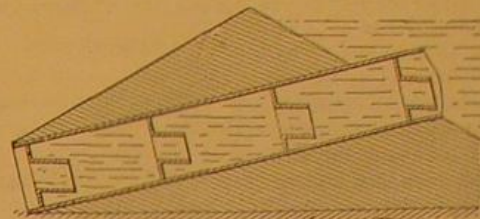
are subsequently brightened by friction, and tempered. In the hook-making machine, the wire is run from a reel into the machine, and on the other side the fish hook drops out completed, with the exception that it must be tempered and colored. After the wire reaches a certain point, the requisite length is clipped off. The next operation bars it; the other end is flattened. It passes around the revolving dies, whose teeth, formed like the notched spikes of a wheel, catch it, and bear it from one operation to the next until it is smoothed and filed, when it passes between rollers that give it the prescribed twist and turn, and it drops into the receiver awaiting it.

*Published in numbers by Messrs. Hurd & Roughton, New York city.

THE FISH WAY,

shown in Fig. 2, is a device to enable fish to ascend a fall.

Fig. 2.



Fish-Way.

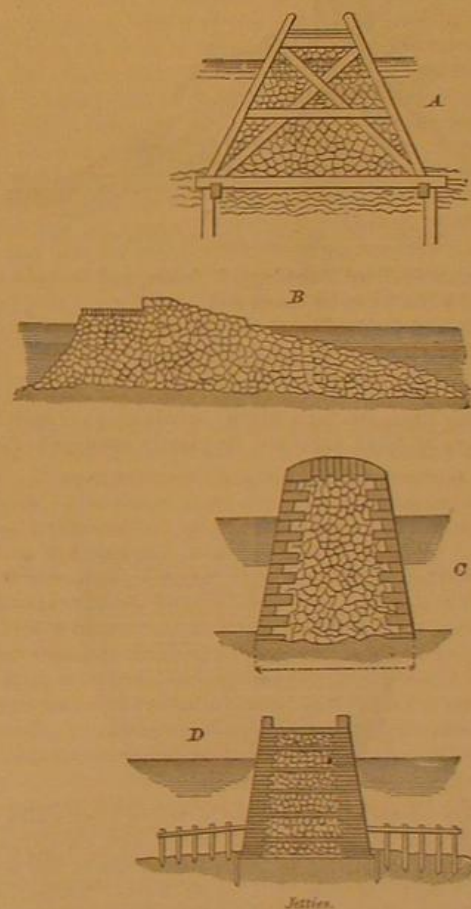
It may consist of a series of steps over which the water descends, turning a fall into a cascade, and sometimes known as a fish ladder; or it may consist of a chute with a sinuous track for diminishing the velocity and assisting the passage of the fish to the level above the dam. In the example, it is an inclined chute having a series of chambers containing comparatively still water, the current being confined to a relatively smaller space.

The success with which Captain Eads is meeting with his construction of willow jetties, at the delta of the Mississippi river, will render interesting the various other forms of

JETTIES

presented in Fig. 3. Although limited to no particular form, a very common construction of jetty is a timber framing, A,

Fig. 3.



secured by piles or loaded with rubble. It is often built in the manner of a sea wall having a double row of sheeting piles, the interval filled in with rubble or *béton*. The latter is excellent. The term jetty is also applied to expensive and solid erections of masonry, and to hard or landing places for boats.

Telford's jetty, B, at the eastern arm of Kingstown harbor, Ireland, is an example of a jetty made of rubble, with a track and parapet of coursed masonry. The foreshore, in most works of this kind, is faced with patched stones, that is, an outer layer in which the undressed stones are not laid at random, but deposited end on, beginning at the lower edge, and so caused to bind and become mutually sustaining.

Jetties of masonry, C, have usually ashlar facings and heartings of rubble or concrete. The walls filled in with *béton* will be nearly equal to a solid mass; in fact, *béton* itself makes a wall of such tenacity that its strength is equal to a homogeneous block. When the ashlar masonry is filled in with earth, it requires a bond; when this is masonry, the counterforts take the form of division walls, which thus reduce the jetty to a series of compartments. The stones of these horizontal bonding courses should be cramped and joggled together, and the top carefully paved to prevent infiltration.

The southern jetty, D, of the port of Havre is exposed to violent storms and a powerful littoral current. It exemplifies the ashlar facing, horizontal bonding walls, rubble filling, paving, parapets, aprons of piles and *pierre-perdue* to protect the foundations from the repercussion of the waves, all executed in a style which has provoked the admiration of those who have understandingly examined it.

FELTING.

The mechanical features of the operation of felting are derived from the jagged character of the edges of some animal fibers which enables them to pass in one direction, that is, root first, but opposes their withdrawal. When the fibers are pressed together by suitable means, the projections interlock, and a compact fabric is produced.

In Fig. 4 are represented several

FELTING FIBERS

as seen under the microscope. *a* is a fiber of Saxony wool, somewhat less than $\frac{1}{1000}$ of an inch in diameter. *f* is rabbit hair, and *b* beaver down, which has a diameter of about $\frac{1}{1000}$ of an inch. *c*, *d*, and *e* are muskrat, nutria, and hare fur. They all show the jagged edges which confer upon them the characteristic felting quality.

M. Du Challu, the well known African explorer, describes a

PRIMITIVE EASY CHAIR, devised by Obindji, a chief of a tribe living in the Gaboon country. This dusky potentate is represented, enjoying a siesta in the offspring of his inventive genius, in Fig. 5. The chair is nothing more than a slab of wood which

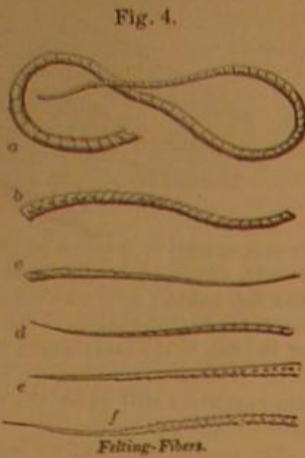


Fig. 5.



Obindji in his Easy-Chair; Gaboon, Africa, A. D. 1870.

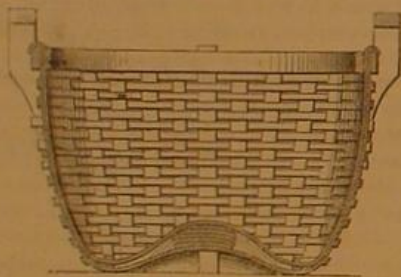
rests on an inclined four-legged frame, and is held from sliding by blocks at its lower end.

Figs. 6 and 7 relate to

BASKET MAKING.

For the finer kinds of baskets, osier is the material most commonly used, but for a coarser article strips of split hickory, oak, or black ash, are frequently employed (Fig. 6.)

Fig. 6.



Split Basket.

Osiers are prepared by soaking in water, after which they are split, cleaned, and bleached in the sun. A number of rows are laid crosswise to begin the bottom of the basket, and are woven together by a spiral weft of wands, which pass alternately over and under the radial wands, to which others are added as the size increases. The wands are bent up to form the sides, and other rods are woven in and out between them, until the basket is made of the required

Fig. 7.



Basket-Making.

height. The edge or brim is finished by turning down the projecting ends of the ribs, whereby the whole is firmly and compactly united. Handles are formed by forcing two or three osiers, sharpened at the ends and cut to the proper length, down the weaving of the sides and close together. They are pinned fast near the edge and afterwards bound or plaited.

Hydrophobia and Intemperance.

Mr. L. N. Noyes, of Boston, Mass., sends us the following, from the Brooklyn Argus:

"Hydrophobia, in the dog, I am satisfied, is the result of the animal having been inoculated by biting some person suffering from the disease of intoxication. Startling as this theory may appear, there is not the least question but that the facts will bear it out. First, hydrophobia and mania a potu are identical in most physical conditions—subjects dead of either disease presenting nearly the same autopsy. Second, the saliva of a man dying of delirium tremens, and that of a dog suffering from rabies, bear the same chemical

analysis. Third, the entire system of the patient suffering from alcoholic madness is so poisoned that rapid inoculation will follow any contact with the virus of the blood. Fourth, the bite of a man in an alcoholic fit has been known to result in hydrophobia. As to the application of these facts: First, with the canine race, hydrophobia is never spontaneous; with man, the disease is known to be. Second, there is not a case on record of a dog having died of hydrophobia that will not admit of proof—if the facts can be ascertained—that the dog had previously bitten an intoxicated person, or had been attacked by some other animal suffering from a like inoculation.

GEORGE WILL JOHNSTON, Superintendent
Brooklyn Society for Prevention of Cruelty to Animals."

We think the statements here made are without foundation: In regard to the first assertion, that hydrophobia and mania a potu are identical, by which we presume the writer means that similar symptoms are developed in both, we would refer him to the works of the best authorities, in which he will find that they differ in the most important respects. That the autopsy in both cases is similar is quite natural, since there are no well marked anatomical lesions in either; nor are there in hydrocyanic acid poisoning, tetanus, etc. Secondly, as to the saliva of a man dying of delirium tremens, etc.: we do not fully understand what the writer means. If it is that the same abnormal principles are found in the saliva of both cases, such as would produce hydrophobia if introduced into the healthy circulation, we can only reply that this could only be proved by a number of experiments, which have not, as far as we are aware, ever been made. We almost daily hear of cases where a nose, an ear, a cheek, or a finger is bitten off in a drunken broil, without hydrophobia resulting. Thirdly, there is no virus of the blood in alcoholism. According to Flint, Sr., Minuyer, Watson, Reynolds, Duglison, and many others, the etiology of hydrophobia is not known; while it never appears in the human subject without inoculation in the correct sense of the word, and not as Mr. Johnston uses it. The last deduction is too absurd to demand attention.

Correspondence.

The Centennial Trial of Steam Fire Engines.

To the Editor of the Scientific American:

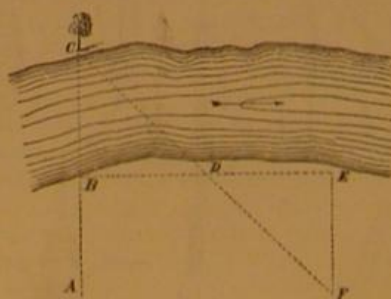
Will you please correct an error in your otherwise admirable account of the trial of steam fire engines at the Centennial?

The judges were assisted by Mr. Wellington Lee, as expert, not by a Mr. Wellington as you printed it. Mr. Lee is well known as a member of the firm of Lee & Larned, who, after Latta of Cincinnati, were the pioneers in steam fire engines, and first made them an established success. He is on all accounts the most competent man living to fill the exceedingly difficult position of expert assistant to the judges. Newark, N. J. CHARLES T. PORTER.

To Measure the Width of a River.

To the Editor of the Scientific American:

Let A B represent the line of survey (the course being at any point of the compass), striking the river bank at B. Mark a tree or bush on the opposite bank, in line with A B. Then lay off 25, 40, 50, or any number of feet from B to D, at right angles with the line A B; from D to E lay off the same distance as from B to D; then from E, walk, at right angles to B E and parallel to line A B, until you reach point



F, which is in line with points C and D. Then measure from E to F, which will be the same distance as from B to C, or the width of the stream. A. S. LEHMAN.
Fort Cameron, Utah Ter.

(For the Scientific American.)

A LESSON FROM THE MACHINE TOOLS AT THE CENTENNIAL.

It is somewhat remarkable that, while the exhibits in Machinery Hall show the advancement in special manufactures and processes, yet, in the tools and appliances for producing the machinery, but little progress seems to have been made during the last thirty years. If we examine the loom, the printing press, and the woodworking machinery, our advance is marked by complete and successful applications of new and original principles. But if we turn to the lathe and the planing, drilling and slotting machines, in fact to any of the tools used in the construction of machines, we shall find that we have reached a platform where we may "rest and be thankful," but beyond which we have apparently but a small prospect of further progress. If we examine the lathe, and ask ourselves in what broad particular we have improved upon the old Smith, Beacock, and Tannett lathes of thirty or forty years ago, we shall not readily find an answer. We have the same bed, the same cone mandril, the same gear, screw-cutting, and independent feeds, the same cross feed, the same compound rest, the same tail stock, in fact, the same design and general arrangement all through; and with the exception of the introduction of the

universal chuck, our chucking devices are identical. If we turn to the lathe cutting tools, we shall find that our practice has been stationary. In planing machines, we have adhered to a like general arrangement of parts; and the departures from old practice are not worth mention. The slight modifications consist in arrangements for a quick return motion by means of an extra pulley and belt instead of differential gearing, and in the application of an independent rest attached to the uprights for planing vertical faces. In planing machine cutting tools, we have made no innovation; and the only departure from the old time practice has been in the modern plan of taking a finishing cut on cast iron with a broad, flat-nosed tool with a very coarse lateral tool feed. In shaping machines, we have made some departures in the entire design, giving to one machine capacity for a much wider range of work. The sliding head has been made movable upon the bed, and various attachments for the table have been introduced. But the machines built by Maclear and March, a generation since, had a quick return motion, cone mandrils for circular work, and a vise chuck (as good as any we remember to have seen, except that lately introduced by Thomas & Co., of this city); whereas we do not know of a modern shaping machine equal in capacity to the Nasmyth "puff and dart" machine of thirty years ago. That machine, which is still extensively used in England upon the edges of armor plates, had a stroke of five inches and made 100 cutting strokes per minute. Referring again to the various attachments for the table, but very few of them are used for general work. In cutting tools for shaping machines, we have no modern innovations whatever. In drilling machines, our progress has been confined to the introduction of multiple machines, adapted to special work, and in various forms of radial drilling machines, constituting a more marked improvement than in the machines above mentioned; but in the drilling machine pure and simple we have made no substantial progress, except it be in the introduction of the twist drill, which is decidedly a step forward in drilling fine work. The Maclear and March drilling machines above mentioned were as substantial in their framing, and were provided with self-acting change feed as well as hand feed; for light work a treadle feed was employed, leaving both hands free to manipulate the work. In screwing machines, we may justly lay claim to advancement in the introduction of solid dies, and in the use now common of segmental dies fitted to adjustable chucks; so that, while the dies cut the whole thread at one cut, they thus avoid the strain on the sides of the thread, which is inherent in those dies which are adjustable and require to take more than one cut to make a full thread. Another modern improvement is in the dies, which are made to throw open when the thread to be cut is finished, so that the dies do not require to travel back over the thread, a movement which abrades the cutting edges of the die teeth, and also entails a loss of time. We have also added pumps for supplying a more copious stream of oil to the dies; so that, taken altogether, we have made satisfactory progress, notwithstanding that the tap has maintained its original form, except it be in our having adopted a standard angle and pitch.

Our greatest degree of progress has been in the milling machine, which has been given a very wide range of useful application during the last thirty years. But milling machines and milling cutters, of the same shape as those at present used, and with self-acting feeds, were employed years ago; but their field of employment was then comparatively limited. In the slotting machine, we know of no substantial improvement made during the last twenty-five years, and but little indeed in a much longer period. The slotter introduced by Sharp, Stewart, and Co., of Manchester, England, about the year 1855, had a box frame, and as complete an arrangement of change speeds and table movements as any exhibited at the Centennial. In boring machines, we have made considerable improvement, especially in the introduction of those of the horizontal type.

In none of these machines, however, have we succeeded in attaining higher rates of cutting speed and feed than were formerly used. It is only when we turn to special machines that the march of modern progress becomes visible. The Monitor lathe, for example, will produce infinitely more small work than was formerly attainable by any machine worked by one operative. It is, however, scarcely just to term it a lathe, since it is more properly a special machine having definite limits of useful application. The introduction of solid emery wheels is another modern improvement, greatly facilitating our operations upon hard metals requiring to be very true, but in no way advancing us in the practice of polishing, for which purpose the wooden wheel, covered with leather and coated with emery, still holds its own. So likewise for many purposes the quick running grindstone has not been displaced by the emery wheel. In polishing processes our progress has been but little, the greatest innovation being in the employment of rag wheels.

In many of our special machines, we have merely enabled the ordinary mechanic to produce as much and as good work as the most expert workman did formerly; and we have lowered the standard of capability of our mechanics in a proportionate degree. This, however, is not in the main to be regretted, since, having the improved machines, we do not as a rule require the expert workmen. The only attendant evil lies in that, though we have greatly enhanced our ability to produce new machines, we have in a partial degree produced a less skillful class of workmen to repair them. It is true that worn out parts may be duplicated, but that is not sufficient, for the reason that the new part is of the original size, whereas the repaired part requires in a majority of cases to be made sufficiently larger to compensate for the wear in the part to which it is attached. Thus, if a hole is

worn larger and the bolt smaller, a new bolt of the original size will not fit the enlarged hole. There are, furthermore, many classes of work which a skillful workman can fit together more quickly or economically with the hammer, chisel, and file than can be done by the aid of machine work; but to be sufficiently expert to do this, the mechanic requires to be vastly more skillful than our modern practice enables him to become.

The United States has undoubtedly taken the lead in the application of special machinery for special purposes, and hence possesses the largest proportion of special workmen, that is to say, men having more knowledge as to how a piece of work should be done than they have manual or manipulative skill to do it; and it is mainly from this class of men that our inventors are drawn. The workman who does not find it difficult to handle and manipulate his work becomes satisfied with and wedded to the process or means by which it is made or manufactured; while he who finds the existing means of production difficult and tedious begins at once to think out some better means of producing the same result. And though the difficulties to be overcome may preclude his entire success, he generally attains it in some degree; while others, taking up that part in which his object was attained and profiting by his failures, search in a new direction to overcome the obstacles which proved to him almost insuperable. It is from these causes that our triumphs in mechanics have been almost invariably practical. It is a common idea that it is the cost of labor to which we owe the greater part of our inventive progress; but there can be no doubt but that, to the causes here pointed out, we are much more large indebted.

Had it been the undue cost of labor, we should have undoubtedly expected to look to theoretical men and capitalists for the innovations; whereas our inventions have been the productions of practical men, with only a partial manipulative and mechanical education: of those men, in fact, who, experiencing the practical difficulties, set about to avoid them by machine manipulation, leaving it to the theorists to follow, and so cover the principles governing the action of the machine. With the diagrams, formulas, and laws that they produce, the inventor is very frequently lost in astonishment at beholding the cloud of theoretical considerations enveloping his successful productions, and innocently, though naturally, wonders how he came to devise so simple a machine involving such learned considerations, of which he had not the slightest knowledge. The American mechanic, in fact, not satisfied with the capacity of the ordinary machine tool, and not having had sufficient experience to wed him to a precise method of operation, sets about to first make those tools as perfect as possible, and next to supplant them, whenever practicable, by taking the processes in detail and designing new tools, bringing the appliances for planing, turning, grinding, polishing, and screw-cutting together in one machine, if necessary; and steadily pursuing his end, adopting new ideas wherever he could find them, profiting by others' failures, and substituting for them his own ideas, which might be successful or otherwise, the latter case merely showing the necessity for further experiment. Thus every failure becomes a success, inasmuch as it is a sign post to a road that was not to be taken, besides being a notice to search in other directions. How far we have profited by this practical process will be shown on a future occasion.

J. R.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

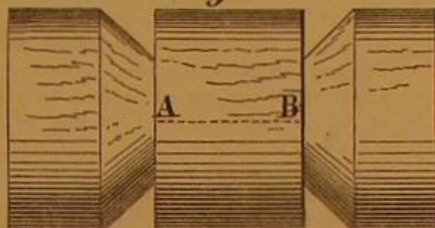
SECOND SERIES—NUMBER XIII.

To resume, then, having sawn out our piece of wood for the flange, we plane up one side, and set a pair of compasses to the radius of the required flange, and mark a circle upon the piece of wood, and then saw off the corners nearly to the circle. We then true up a facing chuck in the lathe, and fix the flange to it by screws passing through the chuck from the back, placing them far enough from the center to avoid their coming into contact with the hole which we shall require to bore in the flange. We then dress off the face of the flange to nearly the required thickness, using the gouge to rough it out with, and the scraping chisel to finish. It is not necessary to finish right down to the center, but merely down to a diameter somewhat smaller than the hole in the flange will be. Our next procedure is to mark the size of the hole, which is done by setting the compasses to the required diameter, and then holding them with one leg resting upon the hand rest; and by bringing the point into contact with the face of the work, we may describe upon the latter a true circle, somewhat smaller in diameter than that required. This circle will serve as a guide to us while we hold both compass points against the work to describe a circle of the correct diameter, which will be done by keeping the compass points at equal distances, one on each side of the circle first described. We must, in the last operation, hold the compass points lightly against the work until we can see that the line described by one point falls in the same line as that described by the other, and then we may make a deep mark. This method is quite as easy an operation as setting the compasses to the radius of the hole, and, putting one leg in the center of the work, describing a circle with the other; and this process is also more exact when the wood is rough. We next take a chisel of about $\frac{1}{4}$ inch wide, and cut out the hole at one cut by forcing the chisel lightly through the thickness of the flange, taking care to cut the hole nearly $\frac{1}{2}$ inch too small, so as to allow of finishing with the diamond point or side tool. The hole being finished, we may turn the outside diameter of the flange with a very sharp gouge, leaving

about $\frac{1}{8}$ inch for finishing, which may be done with the scraper. When the scraping chisel, as indeed all scraping tools, is in proper order, a slight burr can be felt on the top face of the tool, which is caused by oilstoning the beveled face of the chisel last.

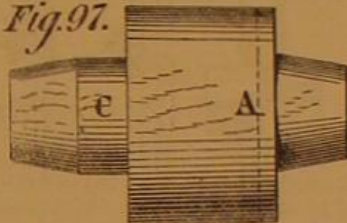
To form the body of the pattern, we take a piece of timber of sufficient size to make the hub and core prints in one piece; and with an ax, we hack off the corners so as to save lathe work. We then place it in the lathe between the centers, using the fork shown in Fig. 48 as the running center and to drive the piece of wood, and screwing up the back center sufficiently firmly to hold the wood tightly. The large diameter is turned to its size with the gouge and scraper, using the latter to finish with, and bearing in mind that the wood is apt to become loose between the lathe centers by reason of the latter becoming imbedded in the wood; and it is necessary therefore, during the earlier portion of the turning, to try the back center and screw it up into the work, if necessary. Then, with the skew chisel, we cut two recesses, as shown in Fig. 96, the distance from

Fig. 96.



A to B being the length of the body or hub of the pattern, and the small diameter of the recess being a little above the required diameter of the core prints. We next turn down the core prints to the required sizes, and turn the part shown at C, in Fig. 97, to fit the hole tight to the flange;

Fig. 97.



and it will be perceived that, by leaving a longer end outside of the recess or nick at one end than at the other, we have left room for the flange, and so kept the core prints of equal length at each end, as shown in Fig. 97. The part that protrudes through the flange will in this case be for the top print, and it is therefore given an excess of taper, for reasons before explained. The hub or body of the pattern is also made taper, being a little the smallest at the end farthest from the flange (A, in Figs. 87 and 96), because this hub, being cast endwise, requires draft to permit it to be extracted easily from the mould.

Having brought our pattern, as nearly as possible, to the requisite size and form with the cutting tools, it is necessary to consider those final processes which so much add to the appearance and smoothness of pattern work. The first of these processes is termed sand-papering or glass-papering. Sand paper is a sort of Will o' the-wisp to the beginner, luring him on to scamp his work, under the impression that sand paper will hide the defects and bring it all right, while the fact is nearer the reverse; for let a pattern be never so truly shaped and turned, if the sand-papering be injudiciously performed, the sharpness of its outline will be destroyed, and very likely its size and shape be seriously interfered with. It is true that it is scarcely possible to do much damage to large surfaces; but that is merely because of the great disproportion that would exist between an error engendered by sand-papering and the whole size of the pattern itself. If we have an inch cube to sand-paper, and should take $\frac{1}{4}$ inch more off one side than off another, our error would amount to the $\frac{1}{4}$ of the length of the pattern; but had the same thing been done upon a 12 inch cube, the error arising therefrom would only amount to the $\frac{1}{48}$ of the length of the pattern. Again, to remove $\frac{1}{4}$ inch from one side of each of these respective cubes, we should have 144 times as much wood to abrade away in the one case as in the other; so that it will be readily perceived that the difficulties attending the sandpapering of a pattern, so as to preserve its true form and size, increase in a two-fold ratio as the size of pattern diminishes, until at last it becomes impracticable. Exactly where this point is reached it is not possible to state; it will, however, vary with the capabilities of the workman, the steadiness of his eye and hand, and the nature and material of the work. It must have happened to many that they have made patterns so small that they dared not attempt to sand-paper them, and that they have turned intricate details upon a piece of work which could not be preserved in their sharpness under the abrasion of sand paper. While therefore we respect sand-paper, let us respect our tools more, and let the pattern or core box, as the case may be, be brought as nearly to the form required as practicable with the cutting instrument, and then let the sand paper be applied, not by folding it together and rubbing it upon the work, but by considering the shape we intend to finish, and preparing a piece of wood to correspond to the shape. Such a piece of wood is called a rubber. A flat surface requires a flat rubber, a convex surface a concave rubber, and vice versa. Rubbers are made of a size suitable to hold in the hand, and in length range up to 12 inches. Longer than this would be useless for one

sheet of sand paper, and that is all that is generally used at a time. Turned cylinders make good rubbers, for core boxes that are semi-circular, up to about 3 inches in diameter; above that size, the turned rubber becomes clumsy, and a piece flat on one side and planed to suit the curve is used. Such a piece is shown in Fig. 98. To use it, place one fold

Fig. 98.



of sand paper only around the rubber; and applying it to the work, move it over the surface of the work, and across the grain of the timber, if it is possible. If the size of the work is smaller than the rubber, we must take short strokes so as to be able to move the latter steadily, and not round off the work at and towards the edges. A very good plan, where extra care is required, is to either glue the sand-paper to the rubber, or else fasten it with a few tacks. Sand-paper glued to a flat board is very useful for small surfaces; but in this case, we rub the work upon the paper, and not the paper upon the work. The grades of sand paper used upon pattern work range from No. $\frac{1}{2}$ up to No. 2, Nos. 1 and 1 $\frac{1}{2}$ being most commonly employed.

The surfaces of the hub or body of our gland pattern being straight in their outline, we sand paper them in the lathe with the paper wrapped once around a flat rubber, applying the paper lightly to the work, and moving it very slowly over the work in the manner in which a file is used. We next fasten the flange to the body by gluing it by using finishing nails, or by both. If finishing nails are used, care must be taken to use a bradawl before inserting the nails, for fear of splitting the work.

To make the pattern in the manner shown in Fig. 90, the method of procedure is the same as the above, with the exception that the tapering of the core prints must be *vice versa*, as in this case the core print the farthest from the flange will be the top one in the mold, and must therefore be given the most taper. And since the body of the pattern will lift with the cope, while the flange will remain in the novel of the flask, when the mold is taken apart (as shown in Fig. 91), the flange of the pattern must be made an easy fit to its place on the body or hub, and must not be left of a tight fit, as in the former case. A pattern of the form shown in Fig. 92 may be turned, flange and all, out of a solid piece of wood; or if too large for this, we may plane up a piece for the flange and glue a hub to it; and when the glue is dry, turn up the whole pattern at one chucking in the lathe.

Protection of Buildings from Lightning.

Professor Clerk Maxwell read an abstract of a paper before the Mathematical and Physical Science Section of the British Association at the recent meeting at Glasgow, in which he stated that those who erected lightning conductors had paid great attention to the upper and lower extremities of the conductor—having a sharp point above the building and the lower extremity carried into the earth as far as possible. The effect was to tap, or, as it were, to gather the charge by facilitating the discharge between the atmospheric accumulation and the earth. That would cause a greater number of discharges than would have otherwise occurred; but each of them would be smaller than those which would have occurred without a conductor. That arrangement was therefore more for benefit of the surrounding country, and for the relief of the clouds laboring under an accumulation of electricity, than for the protection of the building on which the conductor was erected. What was really wanted was to prevent the possibility of an electric discharge taking place within a certain region. An electrical discharge could not occur between two bodies unless the difference of their potentials was sufficiently great compared with the distance between them. If, therefore, they could keep the potentials of all bodies within a certain region equal or nearly equal, no discharge could take place between them. That might be secured by connecting all these bodies by means of good conductors, such as copper wire ropes. It would, therefore, be sufficient to surround a powder mill with a conducting material, to sheath its roof, walls, and ground floor with a thick sheet of copper, and then no electrical effect could occur within it on account of any thunderstorm outside. There would be no need of any earth connection. They might even place a layer of asphalt between the copper floor and the ground so as to insulate the building. If the mill were struck, it would remain charged for some time, and a person standing on the ground outside or touching the wall might receive a shock, but no electrical effect would be perceived inside even by the most delicate electrometer. A sheathing of copper was by no means necessary in order to prevent any electrical effect taking place. Supposing a building was struck by lightning, it was quite sufficient to enclose it with a network of a good conducting substance. For instance, if a copper wire were carried round the foundation of a house, up each of the corners and gables, and along the ridges, that would be a sufficient protection for an ordinary building against any thunderstorm in England; but it might be well, to prevent theft, to have it built in the wall, and then it would be necessary to have it connected with some metal, such as lead or zinc, on the roof. It need scarcely be added, said the Professor, that it is not advisable during a thunderstorm to stand on the roof of a house so protected, or to stand on the ground outside, to lean against the walls.

IMPROVED ENGINE INDICATOR.

Every engineer who has had occasion to apply the indicator to engines running at a high speed has, doubtless, been made unpleasantly aware of the disturbing effect of the weight of the parts which move with the marking points; for notwithstanding the great improvements which have been effected over the first instruments in the way of reducing the disturbing momentum of these parts, there still remains much room for improvement in the same direction.

Some of the conditions necessary to the best steam economy are a high boiler pressure, prompt and free induction, a quick cut-off, reduced clearance, a high ratio of expansion, and a reasonably high piston speed. But it unfortunately happens that the above conditions are exactly those under which the momentum of the moving parts of the indicator produces its maximum of disturbance. Hence, since the introduction of improvements in automatic cut-off engines, through which engines of that class, owing to their not being subjected to the limitations of speed imposed by "releasing gear" cut-off mechanism, can now be made of any size, however small, and run at any speed, the need of a corresponding improvement in the indicator has become apparent; and to a desire to meet this requirement, the instrument illustrated herewith owes its origin.

Fig. 1 is a perspective view, from which it will be seen that the pencil is inserted directly in the end of the lever, A, the other end of which is pivoted to the vibrating bracket, B, which, being pivoted at C with freedom of movement, allows the path of the pencil to be controlled by the light link or radius bar, D, which is pivoted at one end to the standard, E, and at the other to the lever, A. These parts are so arranged with reference to each other that the curvature of the path of the end of the bar, D, exactly neutralizes the tendency of the pencil end of the lever, A, to move in a curve, and so that the latter is thus constrained to move in a straight line. The lever, A, having only the pencil to carry, is made only of sufficient strength to give the necessary pressure of the pencil to the paper; and the bar, D, having but a slight duty to perform, is also made extremely light. In fact the weight of the parts is claimed to be, by actual test, less than one third of that of the lightest system, hitherto produced, having a parallel movement.

Fig. 2 is a vertical section of the cylinder, piston, and its connections. F is the piston, the stem, *f*, of which is short, but is supplemented by a hollow trunk, G, which is screwed on its end, and which, passing through the cap, H, steadies and guides it. The connection, I, which connects the piston with the lever, A, passes down the inside of the trunk and has a head or collar, *i*, the upper and lower surfaces of which are respectively convex and concave, and are concentric with each other. The concave surface rests on and fits the hemispherical end of an adjustable stud, which is screwed into the end of the piston stem, *f*, and the upper or convex surface fits and is secured by an internal collar in the trunk, G, the whole forming a universal compensating joint which allows both the lateral play required by the parallel movement, and the axial movement of the head, K (which

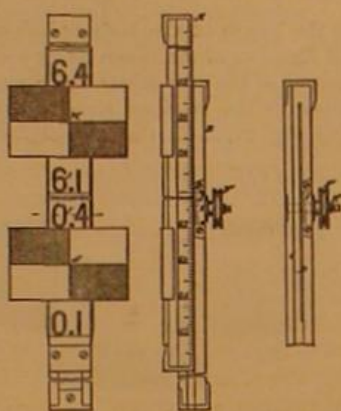
carries the lever system), by which the pencil is brought in contact with and removed from the paper. The connection, I, is pivoted to the lever by a taper steel pin. The head, I', which embraces the lever, is separate from the rod, which is screwed into it and secured by a lock nut, *i'*, which allows the length of the connection to be varied to suit variations in the length of the springs. It will be observed that this arrangement involves but two joints between the piston and the pencil, and these are of a substantial and durable character. The pivots at the ends of the brackets, B, are also taper steel pins.

Fig. 2 also shows a minor improvement in the arrangement of the spring in the paper barrel. The drum, L, which contains it, is covered by a milled edge cover, M, to a hub on which the inner end of the spring is attached, so that, by turning this cover, the tension of the spring may be adjusted as desired and secured by the thumb nut, N, the thread of which is cut right or left, according to the corresponding character of the instrument, so that the force of the spring will always tighten the nut.

A patent was granted through the Scientific American Patent Agency to J. W. Thompson, August 31, 1875, and assigned to himself and the Buckeye Engine Company, of Salem, Ohio, to whom all inquiries should be addressed. The above company are also the sole manufacturers of Thompson's patent automatic cut-off engines, an illustrated description of which was published in the SCIENTIFIC AMERICAN of January 9, 1875.

IMPROVED LEVELING ROD.

We illustrate herewith an improved leveling rod, patented



through the Scientific American Patent Agency by Mr. G. L. Whitehouse, of Farmington, N. H. A represents one part of the rod, and B the other. A has a dovetail or undercut groove in the back, and B has a tongue C, corresponding to the groove in form, and being fitted into it. Between the tongue, C, and the main part of B, is a long slit, D; and a screw stud, E, extends from the tongue out through the back part, and has a clamp nut, F, fitted on it to spring the parts together, and thus clamp them to the part of A be-

tween the tongue and the main parts, A and B, of the rod together at any point, making a simpler and better contrivance than the outside clamp commonly used. G and H represent two targets, which are applied to the part, A, of the rod, the same being in practice six feet apart from center to center, so that, by using the upper one for extra heights, and adding six feet to the reading of the scale, these heights are obtained without reversing the rod and shifting the target, as with the common rod. I is a vernier, together with a scale on the side of the rod, for the rodman to read. The scale, I, on the face of the rod is large, to allow it to be easily read by the leveler.

Velocity of Electric Waves.

A new method for measuring the speed of waves, and at the same time their exact contours, has lately been invented by Mr. Robert Sabine, and tried with excellent results upon lengths of the Red Sea cable at present in course of manufacture at Enderby's wharf, Greenwich, England. Mr. Sabine's method consists in sending currents into one end of the cable (the other end being to earth), and at regular intervals testing the potential of some given point in the conductor. This is done by means of a mica condenser, which is kept in connexion with the point in question until the right interval has elapsed, when it is discharged through a galvanometer. A rotating time apparatus is arranged to close the circuit of the battery at the end, and after a given interval to separate the conductor and discharge it. The interval may be varied from 0.001 to 2 seconds. A similar reading is taken for each interval from 0.001 second upwards until the maximum of the potential due to the position of the point tested is attained. This gives a curve of the exact contour of the wave. The speed is measured by sending two waves of opposite size into the cable, and noticing the intervals at which their neutral point passes two given points in the cable. The difference of the intervals and the distance between the points give the speed.

Acid-Proof Paint.

The following recipe may be of value to some of our readers: The application of water glass or soluble silicate of soda to wood or metal utensils, to protect them from the action of corrosive bodies, is sometimes desirable, and this material, a correspondent in the *Polytechnisches Journal* tells us, may be used with little difficulty if you go the proper way to work. The wood or metal must be perfectly dry to begin with, and free from rust or any kind of fatty matter. Any of the pure mineral colors may be used for mixing with the silicate. Powdered lime, amounting to twenty or twenty-five per cent by volume, is mixed with the pigment, and double as much water glass is then added. The mixture is then applied in the same way as ordinary paint.

A Swiss inventor envelopes the driving axle of locomotives in coils of insulated copper wire, and by the passage of an electric current converts the wheels into powerful magnets, with increased adhesion to the rails.

Fig. 1.

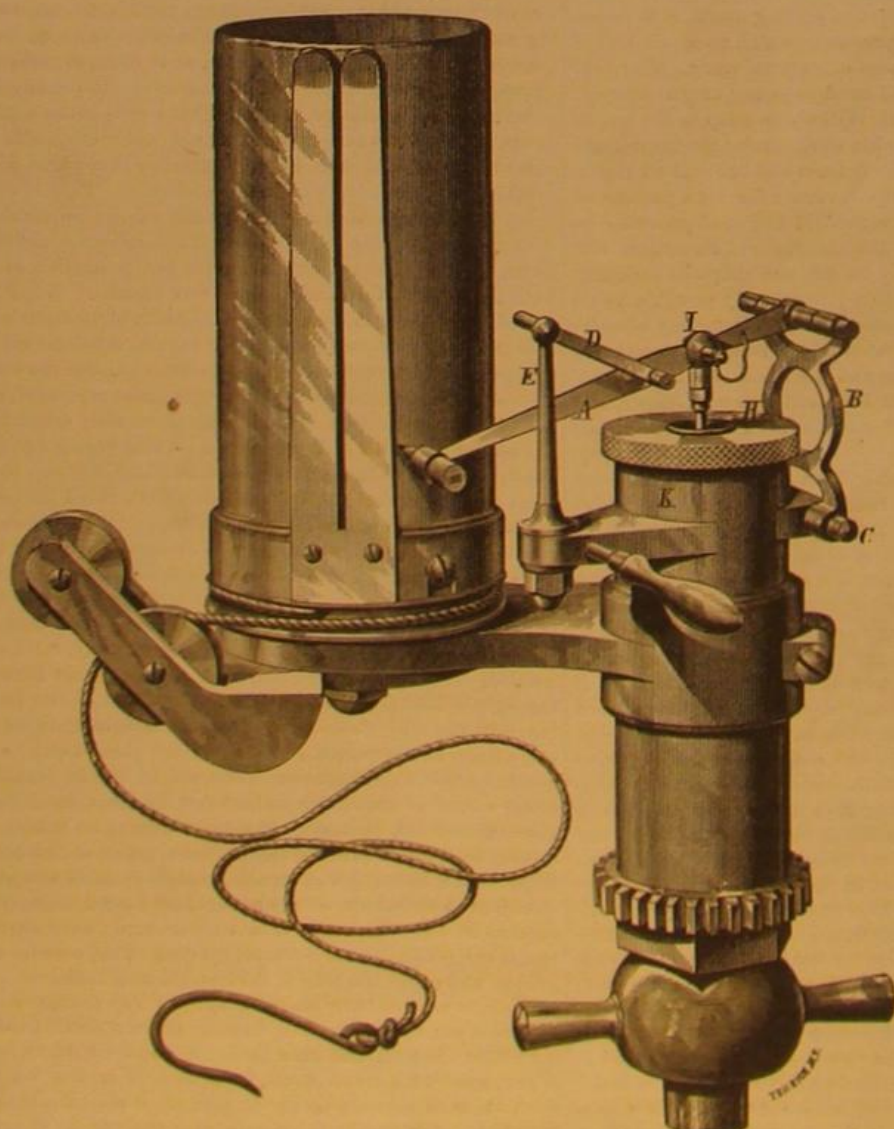
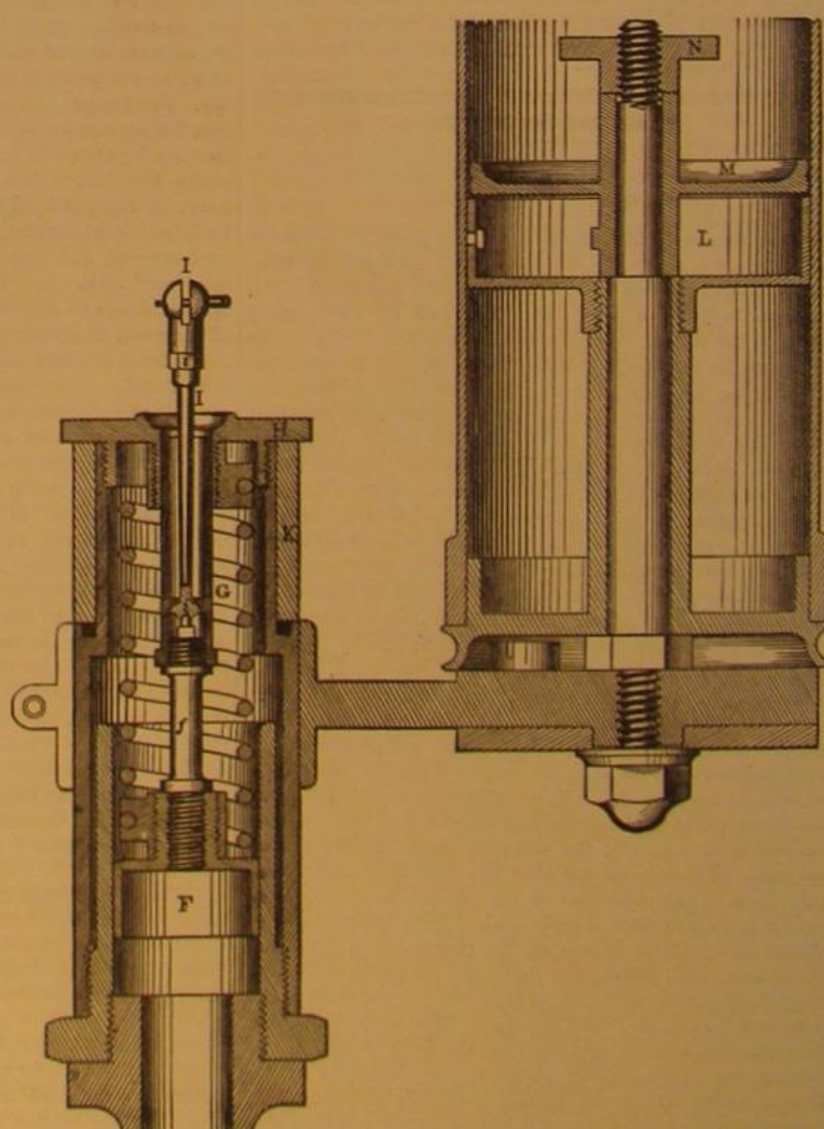


Fig. 2.



THOMPSON'S IMPROVED ENGINE INDICATOR.

A WHITE-FLOWERED BRAMBLE.

Though rarely seen in gardens, this is one of the most striking of all early flowering shrubs; it was originally discovered in 1823 by Dr. James, who found it on the Rocky Mountains, where it grows at considerable elevations. The plant was brought into cultivation, says a correspondent of the *English Garden*, in Great Britain, by Mr. Anderson-Henry, of Hay Lodge, Edinburgh, who raised it from North American seeds, the produce of which first bloomed in May, 1870. Our illustration was prepared from a bush of it 4 feet high, in the Royal Botanic Gardens, Regent's Park, London, where we saw it bearing numerous large white flowers among serrated trilobate leaves. Its single roselike blossoms are succeeded by reddish purple blackberry-looking fruits, which have an agreeable flavor. The plant is perfectly hardy, and is well worth a place in every choice collection of flowering shrubs; its proper position, however, is unquestionably on the outskirts of plantations or in the wild garden. Like nearly all other species of *rubus*, it may be readily increased by means of root cuttings.

True Economy of Life.

The true economy of human life looks at ends rather than incidents, and adjusts expenditures to a moral scale of values. De Quincey pictures a woman sailing over the water, awakening out of sleep to find her necklace untied and one end hanging over the stream, while pearl after pearl drops from the string beyond her reach; while she clutches at one just falling, another drops beyond recovery. Our days drop one after another by our carelessness, like pearls from a string, as we sail the sea of life. Prudence requires a wise husbanding of time to see that none of these golden coins are spent for nothing. The waste of time is a more serious loss than the extravagances against which there is such loud acclaim.

There are thousands who do nothing but lounge and carouse from morning till midnight—drones in the human hive, who consume and waste the honey that honest workers wear themselves out in making, and insult the day by their dissipation and debauch. There are ten thousand idle, frivolous creatures who do nothing but consume, and waste, and wear what honest hands accumulate, and entice others to live as useless and worthless lives as they do. Were every man and woman honest toilers, all would have an abundance of everything, and half of every day for recreation and culture. The expenditure of a few dollars in matters of taste is a small matter in comparison with the wasting of months and years by thousands who have every advantage society can offer, and exact every privilege it affords as a right.—*Philadelphia Commercial List*.

THE COCA PLANT.

The habit of chewing the leaves of the coca plant, common among the natives of many parts of South America, has recently been commented on by many medical authorities; and we present herewith an engraving of a branch of the plant, taken from a specimen in flower of the Royal Botanical Gardens, Kew, England. The use of the leaves of this plant as a masticatory is of great antiquity in Peru; indeed, it is said to have originated with the Incas, and at the present time is common through New Grenada, Quito, and Peru, and also on the banks of the Rio Negro. The South American Indians always carry with them a little bag of the dried leaves, and a gourd containing finely powdered lime, which is mixed with the leaf before chewing. Used in moderation, coca is said to pleasantly excite the imagination, and it also powerfully stimulates the nervous system. In illustration of this, Dr. Spruce remarks that an Indian, with a supply of his favorite coca leaf, will travel two or three days without food and without showing any desire for sleep. Among recent contributions to the history and effects of this plant, we may allude to a paper read before the April meeting of the Edinburgh Botanical Society, from which it appears that without doubt the leaves of the coca, when rightly prepared and used discreetly, possess the effects ascribed to them by all travelers in Peru since Pöppig was there in 1827, but that their effects are not always precisely the same on different individuals. From experiments conducted by Sir R. Christison, the author of the paper above cited, and those of fourteen other gentlemen who undertook to try the plant at his request, the following conclusions have been arrived at: (1) That, taken in quantities of two drachms by healthy persons, it has no injurious, unpleasant, or suspicious effect whatever; (2) that in a very few cases this dose, of an inferior sample, had no effect at all; (3) that in by much the greater number of instances, and with a fine sample in every case, extreme fatigue was removed and prevented from returning, and that no doubt can exist that, in such persons, its restorative and preventive powers will render protracted exercise easy, without any subsequent harm, so far as the restorative is concerned; (4) that it does not in the end impair the appetite or digestion, although hunger, even after long fasting, is taken away for an hour or two; (5) that the use of it probably does not agree with more than a very moderate use of alcoholic stimulants. At the same time the

paper avoided all reference to the possible medicinal uses of this plant. Similar conclusions have also been arrived at by Professor Bouchardat, of Paris, who considers that its services in therapeutics have been most valuable, almost equal to those of cinchona, and that as a nervous and muscular stimulant it ranks with tea and coffee. On the other hand, evidence is not wanting to show that its effects (like those of tobacco, opium, hemp resin, gunjah or bhang, alcohol, and other vegetable stimulants) are certainly highly injurious when used habitually or in excess. A confirmed *conquero*, as an habitual chewer is termed, is said to be invariably known by his haggard look, gloomy and solitary habit,



RUBUS DELICIOSUS.

listless inability, and disinclination for any active employment. Its use is regarded by Europeans as befitting only the Indians; nevertheless, many whites are addicted to it. Dr. Weddell, who inquired very carefully into its effects on the constitution, states, as the result of his observation, the opinion that its habitual use acts on Europeans more prejudicially than on the Indians accustomed to it from early years; and in some cases is attributed to its abuse a peculiar aberration of intellect, characterized by hallucinations.

Dr. Mantegazza, says the *English Garden*, fully confirms the statements of Pöppig, and carefully describes its effects, stating the result of intemperance in its use to be frequently confirmed idiocy. The principle to which the effects of the coca leaf is due has been named cocaine; but much re-

rica and the West Indies, but others are found in Madagascar and the Mauritius. In nearly all the species a distinct pale band runs up the center of the back of the leaf, as shown in our engraving; indeed, in some descriptions of the leaf of the coca plant, we find it stated that two veins, in addition to the mid-rib, run parallel to the margin.

The leaves of this plant are used to make an infusion, as few as four or five leaves making drink enough for six persons. The coca is not to be confounded with the *cacao*, of the genus *theobroma*, which furnishes the nuts from which cocoa, chocolate, and the shells used for infusion are made.

Curiosities of the British Patent System.

A writer in *Chambers' Journal* has been examining into the history of the British Patent Office; and he describes many curious grants in the early history of the office. Among other facts, the writer states that there are four thousand applications for patents every year; and that the office receives the snug sum of \$750,000 a year in fees and stamps.

The first patents, issued in the time of James I, were more in the nature of monopolies or privileges, for which a consideration was paid to shrewd Jamie himself. The very first patent of all was an exclusive privilege for drawing, engraving, and publishing maps of London, Westminster, Windsor, Bristol, Norwich, Canterbury, Bath, Oxford, and Cambridge. The next was for the privilege of publishing portraits of His Sacred Majesty. The third was for an unexplained group of wonderful inventions, for plowing land without horses or oxen, making barren land fertile, raising water, and constructing boats for swift movement on water.

Many of the patents relating to clothing are singular either for their immediate objects or for the language in which they are

couched. One patent for breeches, at a date when trousers had not yet come much into use, described a mode of cutting out and making "to do away with all the inconveniences hitherto complained of"—by the aid of elastic springs, morocco elastic supporters, straps, buckles, etc. Another "protects trousers from mud," by means of a shield attached to the hinder part of the boot heel, which shield receives the splashed mud. Martha Gibbons, early in the present century, patented "a certain new stay for women and others, called the '*Je ne sais quoi*' stay which may be padded in any part when required for persons to whom Nature had not been favorable"—probably a euphuism for "flat figures." George Holland patented a mode of "making false or dummy calves in stockings." A famous *modiste* has an improvement in ladies' dresses, "rendering the same body capable of adapting itself to fit different figures." For those "who cannot bear a ligature round the leg," a patentee has a garter made of steel springs, connected with a silver plate placed in the waistband of the dress. One patent tells of a machine for brushing trousers: a frame work supports a spindle which carries a set of concave brushes; a cylinder of wicker or cane is placed inside the trousers to keep them distended; and the spindle is set rotating by an endless band acting on a beveled pulley.

The searchers after a machine for producing perpetual motion—that dreamy fallacy of the middle ages—have not failed to make their appearance in the patent world. In 1859 two Germans, Krause and Rotman, residing at Milwaukee in the United States, sent a letter to "Her Majesty the Queen Victoria, Patent Office, London." Her Majesty most likely did not read it, but the Patent Office folks did. It ran thus: "Your Majesty, we humbly advertise that we find out the perpetual motion, a machine very singular in its construction, but the same time very important by the power it gives. We intend to secure ourselves the patent right for the United States; and as we are informed your Majesty has secured a reward for the invention, we respectfully ask your Majesty if we may come to show our invention? To prevent mistake, we humbly beg not to believe any person without having the original patent of the United States, and the copy of this letter."

From the cradle to the grave, says the writer, patentees take care of us in some way or other. Even Dolly is attended to. One patent among many tells us that "dolls hitherto made have never been so constructed as to allow of their being placed in a sitting posture, with the legs bending at and hanging down from the knees", and announces that this important desideratum has now at length been secured. Another inventor "gives a rocking motion to dolls' cradles" by an elaborate array of clockwork, eccentric wheel, winch, and connecting rod. One of the early patentees had "a hydraulike, which being placed by a bed-side, causeth sweete sleepe to those which either by hott feavers or otherwise cannot take rest." A patent medicinal powder, compounded of tobacco and herbs, was so meritorious that "if one teaspoonful be struck for a dose up the nose as snuff, will cure various disorders of the hypochondriac and melancholy kind." Eighty years ago many persons believed in a patented mode of curing numberless aches and pains "by drawing over the parts affected various pointed metals, which from the affinity they have with the offending matters, or for some other cause,



ERYTHROXYLON COCA.

Leaf (natural size), single flower, and ovary enlarged.

mains yet to be done before we can speak with any precision as to the properties and uses of this comparatively modern introduction to the pharmacopoeia. The plant is easily cultivated in an ordinary plant stove in a compost of fresh fibrous loam, leaf mold, and sand; when growing it requires copious supplies of water at the root, and frequent syringings with tepid water keep down insect pests. Cuttings of both stem and root may be employed for purposes of propagation. There are about seventy other species of *erythroxylon*, some of which have stimulating qualities, while others furnish a tonic bark somewhat resembling that of cinchona. The bark of one species—*e. tuberosum*—supplies a reddish dye. The majority of the species are natives of South Ame-

extract or draw out the same, and thus cure the patient." One patentee has a thief-proof coffin, in which the corpse is secured by chaining or hooping it to a false bottom; and another a coffin made impregnable by some special application of "tapped and case-hardened screws."

If we cut short our budget of curious patents, it is only because space fails us. Two of the Lillywhites, the celebrated cricketers, have at different times patented bowling machines; in one instance for the adoption of machine bowling in actual play; in the other only for practice at batting, when a trained bowler is not at hand. If the reader will imagine something of the catapult or cross-bow kind, he may form some idea of these cricketering oddities. One patentee has a balloon for catching fish; a balloon, inflated with air and ballasted with water, is supposed to drag or trawl the fishing lines or nets. Before the Manchester and Liverpool Railway was constructed, a bright genius conceived the idea of using balloons to draw a ship overland between those towns, on a tramway of twenty feet gage! A balloon has been patented for preventing sea sickness: a platform, resting on a huge ball and socket, supports the seats for the passengers; the platform is connected by cords with a circle of small balloons; and the balloons are expected to keep the platform always horizontal—of course to the great satisfaction of the passengers. Balloons are also intended, by another patentee, to keep in motion the swings which are such a source of delight at country fairs. One of the very earliest patents was for "a fish call, very usefull for the fishermen to call all kinde of fishes to their netts, speares, or hookes; and for fowlers to call severall kinde of fowles or birds to their netts or snares." In one part the inventor speaks of his fish call as a "looking glass"—rather a puzzle to interpret. Acrobats are invited to use a patent shoe soled with iron, which will enable the wearer, with the aid of a powerful electromagnet to walk head downwards along a metallic ceiling. There are patents for milking cows, for preserving the hands from chapping, and for curing the croup in fowls. Snuff-taking is made easy by "two snuff boxes, one with a slider and the other with a sweep, out of which snuff may be taken without pulling it (the box?) out of the pocket, and without spilling."

CENTENNIAL NOTES.

We continue below our notes on the various objects of interest.

THE SANDWICH ISLANDS EXHIBIT

contains a large number of very curious articles; but owing to the lack of necessary descriptive labels, the visitor is unapprised of their remarkable features. For instance, spread out in a glass case is a cape or tippet, which on close inspection seems to be made of bright yellow feathers. As few birds wear such intensely yellow plumage, it would naturally be supposed that the feathers are dyed. The reverse, however, is the case. The cloak is termed the *kehele*, and the plumes are obtained from the *mamo* or royal bird, under each of the wings of which a single yellow feather grows. Now in the cloak there are perhaps thousands of the feathers, and hence the number of birds which must have been killed to secure the requisite quantity must have been enormous. Add to this the fact that the birds themselves are becoming very rare, and the difficulty of producing the garment accounts for the circumstance that it is seldom found out of the possession of kings. The cape exhibited belongs to Queen Emma, and was loaned by her for display. It is about ten inches in breadth, and quite short, yet its value is about \$600. A relic of the days when human flesh was considered wholesome food is shown in a spittoon inlaid with human bones. Articles connected with the reign of the founder of the line of Kamehameha are religiously preserved, and Kamehameha the First's war clubs form a part of the exhibit. There is also a cane made of a lancewood spear which also belonged to the same doughty warrior. A fiber, little known here, called *olona*, may prove to be worthy of further experiment as a rival of hemp or even of flax. It is the inner bark of a shrub, which at the age of three years is of the right size for stripping. It can be shred into very fine threads, which are remarkably strong. A bird's nest is peculiar from the fact that it contains no vegetable or animal matter. It appears to be made of horse hair, but is made of what is called *pele's hair*, a form assumed sometimes by hot lava.

The highest point reached by vegetation is 12,000 feet, and at that elevation the silver sword plant grows, the flower of which is on exhibition. One large case contains the birds found on the islands. They are not named. One red bird, as large as an oriole and with a brilliant red plumage, is the bird that constructs the nests from *pele's hair*. Castor oil and candle nut oil is also exhibited; the latter is made from a nut bearing the above name.

The Oahu College sends a collection of land shells, containing between 800 and 900 varieties. They are all found on the island of Oahu and nowhere else in the world. Their habitat is under the mosses and lichens attached to the bark of trees. Many varieties are not found alive, and are believed to be extinct.

But few industrial products are exhibited, and native manufacturers appear to be of a very primitive nature. Cloth is made from the inner bark of the bread fruit tree by a kind of felting process; the fiber is steamed and then pounded with wooden mallets, on whose surface grooves are cut. A cloak made in this manner on the island of Tahiti, and ornamented with shells, is shown, and also several larger pieces of cloth or felt, quite thin and tough, and ornamented with floral designs.

From the Micronesian Islands there is an exhibit of beau-

tiful pink corals which are unsurpassed in beauty by any thing of the kind ever seen here. They attract great attention and the majority of them have been already sold. This variety of coral is said to be found nowhere else than on the reefs about these islands, where the natives, who are expert watermen, dive for them.

The full dress of a Caroline Island belle is shown, and consists simply of a cape about a foot broad, made of strips of cocoa bark and worn about the shoulders. A waterproof cloak of novel construction is also shown. At each knot of an ordinary fish net is tied a bunch of seaweed. This being spread over the shoulders, net side under, forms a perfect protection against wet.

The display of firewood is quite large, and includes many curious varieties. Of these the wood called *kou* is said to be the most valuable. It is similar in appearance and character to black walnut, but has a finer grain and is not so heavy. It can be turned into all shapes, and never cracks or checks, as is the case with most woods. A large number of jars are shown made from this wood and the black *koa*. These are used by the natives as receptacles for the food called *poa*, the staff of life among them, a farinaceous food made from a root called *taro*, something like a turnip. This is baked and made into a porridge. The natives do not like it until it begins to ferment.

It is said that the Exposition is not very rich in antiquities, save, perhaps, in the Chinese pottery and old Japan bronzes. To inspect some portions of

THE TUNIS DISPLAY

is to go back to the time of Abraham, at least so far as progress is concerned, for agricultural implements that were used by the patriarchs are but copied in the tools which the Tunisians still employ to till their ground. A plow is shown made of two strips of wood; one, the beam, is crossed by the other at a sharp angle, the lower portion of the latter serving for the plowshare. Its point is shod with iron. Such an implement might be used to stir up the ground, but neither lifts nor turns it. Hand rakes are shown heavy enough for horse rakes. The thresher consists of what an American farmer would call a stone boat or sled, the bottom of which is stuck full of sharp stones. This implement is dragged over the grain as it lies on the floor. With all these discouragements very fine crops of grain are raised; and samples of different cereals are shown, put up in bags. Among them are corn, an inferior yellow variety; barley, which is quite plump and bright; wheat, a quality which would rank as No. 3 in this country; three kinds of beans, white, flat brown, and a small black-eyed variety; caraway, fennel, coriander, and other similar seeds; oats are said to be raised abundantly, but none are exhibited.

An object which is a genuine antique is the mosaic representing a lion and its prey. This was found by Davis' party during his explorations of the site of ancient Carthage. It was found within the precincts of the Byrsa of Carthage, and in close proximity to the site of the Temple of Astarte, the Juno of the Phœnicians. In this vicinity there appears to have been a temple dedicated to Diana, and this lion seemed a part of the pavement of that temple. Every other representation on this vast pavement had relation either to the chase or to wild beasts. Through the ignorance of native workmen of how to handle such easily broken objects, every one was hopelessly destroyed, in the attempt at removal, but the lion, which remains in possession of the Bey. The boldness of the design and exquisite execution of the work assign it to the most flourishing period of Carthage, say 2,500 years ago. The mosaic is about eight by ten feet square, and represents a lion who has seized his prey, a horse or other animal with hoofs, from whose wound the blood is trickling. The stones of which it is composed are about half an inch square and are set in cement.

The principal Tunisian exhibits are of silk, and these are profusely ornamented with gold and silver embroidery. It is a custom among the wealthy to ornament the walls of dwellings with silk hangings above the wainscoting, which is usually of tiles. One of these silk hangings is shown, which is about thirty feet long and six feet broad. It is a pink silk, and is covered with ornaments in various colors sewn on. One case of Moorish costumes contains loose white silk garments called *bourouses*. The silk is of pearly whiteness, and is ornamented with gold embroidery. *Bourouses* of striped silk, in which gold bands are woven, are also shown.

One case shows the trousseau of a Moorish bride. The garments, which are numerous, are all of pure white silk, and are so thickly embroidered with pure gold and silver that they are oppressively heavy. These costumes are all offered for sale. There are also goods manufactured expressly for the Exhibition, scarves, opera cloaks, and shawls. One is made of silk, through which runs a stripe of rough cotton, the effect of which is quite odd.

SOME NEW COTTON AND WOOL MACHINERY

on exhibition in Machinery Hall is attracting considerable attention among manufacturers. A new English gin separates the seed without cutting the fibers of the cotton, by means of a vibrating knife, a roller, and a combined action of fixed and moving grids. At each elevation of the moving knife, the grid which is attached to the same lifts the cotton to the level of the fixed knife edge and to the exposed surface of the roller; and on the descent of the moving knife, the seeds which have become separated from the fibers are disentangled by the prongs of the moving grid passing between those of the fixed grid. The machine on exhibition is about the size of a common 60-saw gin which would require at least 5 horse power to run it; while this

takes but little over 1 horse power. The machines being automatic, one man can feed two of them, whereas on the saw gin he could feed but one. The out-turn of cotton is from 120 to 200 lbs. per hour, and the seeds are much more thoroughly cleaned. There can be no danger from fire, as it would be impossible for it to communicate with the ginned cotton, and it would be effectively quenched by the action of the machine. Regarding safety, it is impossible to get the fingers cut or jammed, as the grids push them aside and prevent accident.

There is also a double cylinder burr picker for the cleaning of wool. The wool is placed upon a feed apron, and, passing between two feed rollers, is carried by the main cylinders on to two burr cylinders acting independently of each other; passing over these, the wool (which is now evenly spread with the burrs on top) comes in contact with a fluted roll, termed a beater or clipper, which removes the burrs and deposits them in a receptacle below. The wool, which is now freed from burrs, is carried by a brush to a beater, which removes all fine dirt. The wool is then blown into a wool room perfectly cool. The inventor of this machine claims that he can clean 500 lbs. of fine or 1,000 lbs. of carpet wool per hour. This picker is manufactured by the Atlas Manufacturing Company, Newark, N. J.

CARRIAGE WHEELS AT THE CENTENNIAL EXHIBITION.

MATERIALS USED FOR MAKING WHEELS.

For making light wheels, hickory is, in America, employed almost universally for the spokes and felloes, and elm or gum wood for the hubs; for heavy wheels, oak is used for the spokes, oak or ash for felloes, and elm, gum wood, or locust for the hubs. Hickory is an indigenous American tree, and is found in all States east of the Mississippi river; but the supply has mainly been drawn from Indiana, Ohio, New England (where it is now very scarce), the Middle States, and also, more recently, from Virginia and Kentucky. The term second growth, as applied to this timber, has from improper use grown to be a misnomer; it really means a growth of timber that springs up, more or less sparsely, on ground that has once been cleared from the forest; but, to justly rate the true value of hickory, each individual tree must be judged on its own merits. It rarely happens that a first growth tree has any value for carriage work, and then simply because it has stood alone. What are known as hedgerow trees generally give the best quality of wood, and they are in their prime when from forty to sixty years old. Hickory is cut at all seasons of the year, but from early fall into the winter is the time generally preferred; and it is claimed that timber cut during this period is less liable to the attack of worms. The butt only of the tree should be used for best work, and for a distance of from six to sixteen feet from the ground, according to the quality of the tree and the place of its growth. The butt is generally cut into lengths suitable for spokes or felloes, and, if intended for spokes, it is then sawn or riven into proper sizes, from center outwardly, and around by the annular growths: while for felloes it is simply sawn into strips of suitable length. The heart of the tree generally contains what are known as the pin knots, or marks of the small twigs which grew from the trunk when very small, and this portion in most trees has a brownish color, which features make the heart wood less salable, although sometimes equal to the whiter wood in all other respects. Four grades of hickory may generally be found in the market, which embrace varieties from the very best down to that which is so poor that it is only adapted for very common classes of work. In countries where this timber is comparatively unknown, the impression prevails that "hickory is hickory," always possessing the same qualities and characteristics; but a more intimate acquaintance shows that there is as much difference between the different grades of hickory as between totally different kinds of timber, some resembling ivory or whalebone for hardness and elasticity, while other pieces possess no more value for wheelmaking than common pine or deal. Prices vary very materially in accordance with the quality, the best grade being worth in the market from three to five times as much as the fourth grade—a point which foreign customers are beginning to learn through costly experience. The best proves the cheapest in the end. The seasoning of hickory for spokes is an important matter, concerning which there exists a diversity of opinions. The method employed by some of our best wheel manufacturers is as follows: After cutting the timber into spoke sizes, it is usually allowed to season in the open air about six months, after which it is placed in the dry room, with a temperature of about 90° Fah., which should not, under any circumstances, be allowed to exceed 100°; and it is kept in this dry room for from ten days to two weeks, according to the size of the pieces. It is then ready to turn and finish, after which it should again be placed in the dry room for a few weeks, before making up into wheels. It is customary with some wheel makers to subject their spoke stuff, after it is cut into spoke sizes, to a process of steaming without pressure, which occupies from one to two hours, the object being to fix the albumen in the wood, render it stiffer, hasten the seasoning, and prevent checking or splitting.

American oak is fully equal in all respects to the best English oak. Take, for example, the dog cart wheel exhibited by Messrs. Hoopes, Brother, & Darlington, and no oak from any country could be better. Oak grows in nearly all parts of the United States, the present supply being received mainly from the Atlantic seaboard, and from Ohio and Indiana. It is commonly cut in the same season as hickory—namely from September to February—from eight to sixteen feet of the trunk being employed, which is cut up in the same manner as hickory. A tree growing in a heavy

clay soil, with exposure to plenty of air and sunshine, is preferable, and the tree is in its maturity when from fifty to one hundred years old.

Elm is found in all the States east of the Mississippi, and the present supply is drawn very largely from Ohio. It is cut in the same season as hickory, but the method of seasoning differs in some respects. When required for hubs, it is usually cut in the required lengths, and a hole bored through the heart; the bark is then removed, and each block reduced to a true cylinder, with the hole for its center. From this point the practice differs in different works, but generally the blocks are then steamed for a short time, to assist in seasoning them without splitting or checking; and after this the ends are dipped, to the depth of about half an inch, in a mixture of hot linseed oil and tallow (or resin), as a further preventive of checking. They are then stored in open sheds, where they remain from two to four years to season thoroughly.

Locust is sometimes used for hubs, and possesses special value on account of its durability; but it splits easily, to prevent which it requires to be carefully banded close beside the spokes. The mode of cutting and preparing it is similar to that employed for elm.

Gum wood, known in some sections as pepperidge, is found mainly in the States along the Atlantic seaboard, growing but sparingly in the West; and south of New York State it is used considerably by carriage builders for hubs. In its qualities it is very similar to elm, being very difficult to split; but it has not the lateral strength of elm, and in driving spokes it is more liable to break between the mortises. The method of preparing it is very similar to that employed for elm, the only difference being that the blocks are not usually dipped, although this treatment would doubtless be beneficial; and its market value is about the same as that of the latter.

WHAT CONSTITUTES A GOOD WHEEL.

The excellence of a wheel depends, first, upon the quality of the material employed; second, upon the proper preparation of this material; third, upon the proper proportioning of the different parts, and fourth, upon exact and skillful workmanship in combining these parts into a perfect whole. Mr. William Thompson Casson lays down a similar standard in his article which appeared in a recent number of *London Saddlers', Harness Makers', and Carriage Builders' Gazette*, wherein he says:

"The gem of the wheel exhibits at the Centennial is an English dog cart wheel, shown by Hoopes, Brother, & Darlington; and from whatever point of view we take it, whether regarding its appearance, workmanship, or material, it is a source of admiration; the spokes and rims are oak, but it requires an experienced eye to detect whether the oak is English or American. They also show landau, brougham, and other wheels of the English pattern, as specimens of their ordinary manufacture, leaving nothing to be desired. Those of the old school of wheel makers, who yet dispute whether any steam wheels can equal those of hand make, would be convinced of the superiority of the former by a close inspection of the wheels shown by this firm; every joint and shoulder is up and close, without having one part squeezed into another, simply because every tenon, shoulder, and surface is made with mathematical precision. From personal experience learned at the bench, this really seems to be the whole secret of wheel making—to have everything tight, true, and fair."

SHAFTS, WHIPPLETREES, AND SIDE BARS.

For shafts, hickory is commonly used by American carriage builders, and answers the purpose admirably. Lancewood, however, from the West Indies, would, without doubt, be preferable; but it is difficult to obtain, and very expensive. It is much to be regretted that not a specimen of lancewood in the rough is exhibited at the Centennial; and although it is used in connection with several of the carriages exhibited, it is so disguised by paint or varnish as to give, to those unacquainted with it, little or no idea of what the timber really is. The valuable qualities by which lancewood is distinguished are great stiffness and elasticity, and remarkable strength. Some builders claim, however, that lancewood is not so safe as hickory for shaft purposes, for the reason that, when it breaks, it is liable to break off short; and to obviate this danger, some foreign builders fasten strips of whalebone under lancewood shafts, by means of round-headed screws. For whippletrees, hickory is used almost universally by American carriage builders.

Wooden side bars, now so popular in connection with light road wagons, are made of various materials, hickory being preferred by the majority of the best builders, while locust ranks next in favor; and experiments have also been made with *bois d'arc*, Chinese chopstick wood (name unknown to us), and lancewood. Lancewood would doubtless prove the best for this purpose, and come into general use, were it not for its expense, and the difficulty of obtaining it in sufficient quantities; for it possesses those qualities particularly demanded for side bars—namely, stiffness, toughness, and elasticity.—*The Hub*.

NOTES ON THE AMERICAN INSTITUTE FAIR.

ENVELOPE MACHINERY.

There is a remarkably ingenious machine at the Fair of the American Institute, which is said to make 3,000 envelopes per hour. A similar apparatus is in operation in the Government building at the Centennial, but there it is not among the machinery, and is thus out of the route usually followed by those who make mechanism an especial study. It is one of those devices which even the practised eye can

not appreciate at a glance, and when at work it goes through its multitudinous manipulating performances so quickly and yet so deftly that the observer instinctively finds himself watching the envelopes come in and the envelopes go out as if a natural phenomenon were taking place, the internal operation of which it were useless to try to fathom. The motion of the apparatus is mainly obtained through cams, and these act on rubber rollers on the extremity of the rods moved. The envelope blanks, previously cut out, are placed on a table. Beside and above the latter is a paste slab whence mucilage runs to distributing rollers, and these in turn cover movable rollers, which are thrust forward to apply the gum to the undersurface of a stamp or plunger. The plunger now descends and takes against the parts of the envelope to which paste is to be applied, and then rising carries the envelope up with it. Now a carrier shoots under the envelope, takes it away from the stamp, and conducts it rearward under a square plunger which, descending, pushes the paper through a square hole, thus bending up its edges preparatory to folding. No sooner is the envelope through the orifice than four little doors or shutters clap over it and neatly fold the edges. Next it falls between arms on a long endless chain which moves very slowly rearward, the envelopes going down one way and coming up the other. This travel is long enough to enable the paste to become dry, a process facilitated by a little rotary fan under the chain, which keeps up a draft of air. Lastly, as each envelope returns to the table of the machine, fingers rise on each side, remove it from the chain, and place it on a small platform which, turning, deposits the envelope neatly on edge beside its predecessors. Then the young lady who presides over this wonderful machine quickly runs her finger over the requisite number of envelopes to form a pack, surrounds them with the usual ornamental strip of paper, and the process is ended.

There is one good feature about the American Institute Fair which occurs to us here, and that is that it offers excellent facilities for the undisturbed study of its contents. It is useless to attempt to examine intricate machinery at the Centennial, owing to the now almost constant crowd; and to post oneself in front of an object with a note book, and to ask questions of the exhibitor, or, worse yet, to try to sketch, is, especially in the latter case, to constitute oneself the center of a throng whose curiosity impels each individual member to ask questions on his own account, or else to constitute himself a critic on the efforts of the amateur pencil. Nothing delights us more, however, than to see the interest manifested by the people in machinery and invention, and in that view we can forgive the annoyance. It would not be a bad idea, though, for enterprising exhibitors to hire artists to sit and sketch their exhibits by the week, by way of advertisement. But this is wandering from the American Institute Fair, where—and here is a contrast to the Centennial—an exhibitor the other day set an engine racing for our inspection, at a most remarkable pace, and no one manifested the slightest interest in the proceeding. People passed, instinctively wagged their heads, as they always do, in time with the machine, and proceeded onwards. The engine in question, we found, presented some features not wholly new, but well worth examining.

THE BALANCE ENGINE.

It has two pistons in its single cylinder. From the front piston and through boxes near the edges of the cylinder cover extend two piston rods, each connected to a crank on the driven shaft. From the rear piston a single main piston rod passes directly through the front piston, then through the middle of the cylinder cover, and connects to a crank formed by making the inner sides, of the two cranks already mentioned, twice as long as the outer sides. That is, imagine a W with the middle angle twice as high as the side strokes, and consider a crank at each angle. The main piston rod would then be attached to the angle at the apex, and the two smaller rods to the angles at the base. The cranks, it will be observed, are set in the same plane, and not quartering, as is usually the case. The steam ports enter the cylinder at the middle and at the ends, and the stroke of each piston of course equals half the length of the cylinder. The steam enters between them and forces them apart, and then enters at the ends and carries the pistons together. Now the sum total of all is that the power is applied to the shaft just as the two hands are to the handle of an auger, and the reciprocating parts are balanced; while the engine—despite the very indifferent workmanship—runs at high speed with little vibration.

THE HARRIS STEAM PUMP.

is quite new, and has a positive action. The main piston, on arriving near the end of its stroke, raises a poppet which admits steam to the valve piston and at the same time closes its communication with the exhaust. This throws the steam valve, which admits steam, to the other side of the main piston, causing it to make the return stroke. The instant the piston moves from under the poppet it drops to its seat, closing the steam and opening the exhaust on that side of the valve piston, which, together with the steam valve, remains at rest until the other poppet is raised to admit steam to the opposite side. There are no outside connecting valves, etc., and the water end is of the double acting plunger pump pattern.

AN INGENIOUS MECHANICAL MOVEMENT

will be found embodied in the Vanhorn & Cranston paper-cutting machine in the main hall. The arm which draws down the clamp to hold the paper, prior to the knife rising from beneath, is pivoted to a long hand lever, near the lower end but above the fulcrum. Hence, when the lever is pulled down, the clamp is carried downward until its further mo-

tion is prevented by the paper under it. The lever then changes to one of the first order, having its fulcrum on the clamp rod pivot, while the former fulcrum now is the pivoting point of the lever end to the carriage which supports the knife. Consequently, further forcing down of the lever lifts the carriage with great force, and the knife is caused to cut the paper. The device is very simple, and so constructed that the greatest power is applied just where it is needed.

As a whole, the fair is interesting, and visitors to the Centennial, sojourning in this city, will do well to visit it. It is especially rich in household articles, and in new designs in furniture, etc. The machinery department is not so well filled as usual; but there are many novelties which will repay careful examination. The attendance is constantly large; and on Saturday and Wednesday nights which seem to be especially favored, the building is generally crowded.

Opening of the New York Aquarium.

The New York Aquarium, located on the corner of 35th street and Broadway, this city, was recently opened to the public. The tanks contain a large number of fish, including a white whale from Labrador, several sharks, a huge sting ray, and terrapin, besides an interesting collection of zoöphytes. A laboratory for naturalists, with the necessary appliances for investigation, is provided; and in the piscicultural apparatus, the process of hatching and rearing salmon may be witnessed. On the opening night, President R. B. Roosevelt, of the New York Fish Commission, made an address on the objects of pisciculture.

A Disastrous Boiler Explosion.

A terrible boiler explosion recently occurred at Zug & Co.'s mills at Pittsburgh, Pa. The boilers in the mill blew up, demolishing that building and half the adjacent rolling mill. Some twenty men were killed and as many wounded. No cause is as yet assigned for the casualty. The boilers were in charge of a careful engineer, and it is stated that they were inspected some five weeks ago and were then in good condition.

NEW BOOKS AND PUBLICATIONS.

THE AMERICAN LIBRARY JOURNAL. Edited by Melvil Dewey, 13 Tremont Place, Boston, Mass. New York city: F. Leopoldt, 37 Park Row.

As its name indicates, this Journal is devoted to the interchange of thought and experience among librarians, and with this aim it enters a field hitherto wholly unoccupied. We have a great many large and excellent libraries in this country; and there is a constant increase going on both in the numbers of these repositories of learning as well as in their contents. To render the vast mass of information thus accumulated accessible to the reading public, to keep his own particular charge up to the latest dates in constantly adding new works, and, perhaps above all, to constitute in himself a living index of what the book makers have done, is but a rough statement of the librarian's duty; and that these ends can be accomplished better by the union of librarians, which the present Journal seeks to bring about, than by individuals, it is hardly necessary to suggest. The first number of the periodical, which is issued monthly, contains a number of interesting communications and papers, among which we note some sensible practical hints to starters of libraries, and a good many ideas for the care, indexing, etc., of books. There is, beside, a useful record of new publications, not merely in this country, but throughout the world. The Journal is elegantly printed, the margins are luxuriously wide, and the present number has an illustration of the new Ridgway library building in Philadelphia. The subscription price is \$5.00 per year, or 50 cents per number.

THE COMPLETE AMERICAN TRAPPER. By William H. Gibson. Illustrated by the Author. Price \$1.75. New York city: James Miller.

We are inclined to think that the author's claim that "this is the most comprehensive work on the subject ever published" is a fair one, judging from the almost endless variety of traps and other devices to effect the capture of animals and birds which he illustrates and describes. He even tells us how to trap the hippopotamus, the lion, and the tiger; and from these great beasts he descends through the scale until he reaches a daintily delicate way of catching humming birds by a few drops of birdlime on the leaves of a lily. Trap making—or, to speak generally, the pitting of human reason against brute instinct and cunning—requires a special kind of ingenuity, which not many possess; and in gathering together all the curious devices described in his volume, the author has done excellent service in helping very many people to ideas which doubtless would never occur to them. The book contains 143 engravings—mainly representative of the apparatus explained—and is written clearly and well. It will be useful not merely to hunters and trappers, but will also serve to exhibit to inventors what has already been accomplished in this particular line.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED METHOD OF CONVERTING MOTION.

Hiram L. Joslin, Mankato, Minn., assignor to himself and Henry K. Lee, same place.—This consists of a reciprocating head working backward and forward among belts, and having clutches or pawls contrived to take hold of one side of the belt going one way, and the other side going the other way, so as to apply the power continuously in one direction.

IMPROVED BRICK MACHINE.

Ferdinand Michel, Dallas, Texas.—The table to receive the tempered clay is attached to the top of the frame from which it is fed into the molds. Followers enter the molds from below, and serve as bottoms to the mold when being filled. A weighted block withdraws the followers when the pressure is removed. By operating a lever, the followers may be forced up to press the brick, and to raise them out of the mold after being pressed. There are other ingenious improvements in the mechanical construction.

FEEDING APPARATUS FOR CARD-PRINTING PRESSES.

William M. Clark, Philadelphia, Pa.—As the card passes down beneath a shelf, its ends pass beneath the flanges of guide bars, projecting downward along the platen to guide the card to the place where it is to be printed. As the card reaches the place where it is to be printed, it is stopped by inwardly projecting curved points, which receive its lower edge. As the platen is drawn back, these curved points raise the card slightly as its lower edge slips from them, so as to release it, should it stick to the platen, and allow it to drop from the press. The arms which carry the points slide upon grippers so that they may be adjusted as the width of the card may require.

IMPROVED APPARATUS FOR REMOVING COKE FROM RETORTS.

Joel F. Rice, Louisiana, Mo.—This consists of a sliding scoop placed on a swiveled support, that is carried by a truck, the scoop being forced into the retort under the coke by a winch, and withdrawn by the same means.

IMPROVED WINDMILL.

Edward Williams, Potomac, Wis.—This consists of a solid wheel of sheet metal, the vanes of which are of concave form in cross section. There is a secondary set of curved vanes outside of the rims to increase the capacity of the wheel. The power is transmitted to the pump rod by a pair of eccentric wheels and a lever, giving increased leverage on the upstroke, with quicker motion on the downstroke, and enabling the wheel to lift from a greater depth. The tail vane is double, and diverges each way, so that the wind has greater power to hold it steady. The connecting rod works upward from the crank to a level, having the pump rod connected to it in such manner that the pump rod has but little vibration in the hollow axis of the turntable, and thus does not require so much space as when the crank works over hollow axes. The main stem is set in the adjustable step, for plumbing the turntable readily when the tower settles.

IMPROVED TOOL HOLDER.

Christian C. Bergh, St. Paul, Minn.—This consists of a vibrating holder for holding engraving and other tools in applying them to the oil or grinding stone, so as to insure the proper angle of the bevel, and thus make the points true. The said holder is an extension rod fixed on a vertical pin at one end, and having at the other end a chuck in which the tool to be sharpened is fastened. The oilstone is placed at such inclination that the bevel of the tool bears fair on the face of the stone.

IMPROVED RAILWAY SIGNAL.

John H. Williams, Albion, N. Y.—This consists of an arrangement of levers and connecting rods, which are combined with a danger signal or flag in such a manner that the same is displayed by the action of a passing train upon levers and rods.

IMPROVED SAND PUMP.

William H. Birge, Franklin, Pa.—This consists of an inner and outer tube, forming together the lower end of a sand pump, arranged to slide one within the other. The inner tube is provided with a rotating valve having a segment of teeth on its outer end, which engages with a rack formed on the edge of a slot in the outer tube. A spring assists the parts to regain their nominal position. The object of the invention is to provide a valve which shall have a positive motion, not depending upon the action of the water or sand to open or close it.

IMPROVED PAPER PULP SEPARATOR.

Joseph S. Smart, Troy, N. Y.—The object is to utilize the coarse and heavy stock that is collected at the bottom of the settling vats in the manufacture of paper, so as to draw the same off to regrind, and conduct it back to the vat for use. To this end, a settling vat is provided with revolving bottom arms, that convey the heavy particles of pulp to an outlet, and, by a connecting pipe, to a grinding engine, that forces the ground particles through a goose-neck pipe back into the vat.

IMPROVED CONDENSER FOR STEAM ENGINES.

Robert Hardesty, Shepherdsville, Ky.—This invention comprises a condensing cylinder surrounded by an iron casing, with a space between condenser and casing. At the top, the casing extends above the condenser far enough to form an air chest. The condensing water is forced in between the casing and condensing cylinder at the bottom by a pump, ascends to the air chest, and enters therein in a shower. By suitable pipes, a portion of the steam is conducted past the condenser into the heater. The general construction is such that, when the engine stops, all the water above the condensing cylinder will soon pass through it, thus cutting off the supply of water to the valves. When the engine starts, the water will rise in the air chest until the air becomes sufficiently compressed to force the water through as fast as the pump supplies it. This will again supply the valves with water. This invention is claimed to suit both the high pressure and low pressure engine. If there is any exhausted steam above the pressure of the atmosphere, it will exhaust part of it into the air and condense the remainder. If the steam is below the pressure of the atmosphere, it will exhaust it by condensation.

IMPROVED BLOW-OFF COCK FOR STEAM BOILERS.

Samuel Myers, Pittsburgh, Pa.—The valve for controlling the discharge of water is made to fit loosely in its case or socket, so as to permit the passage of a small quantity of water around the valve and over the seat while the valve is closing, for the purpose of washing off from its seat any scale or other solid matter that may have lodged thereon. The valve is, however, designed to fit sufficiently tight in its casing to prevent scale, etc., passing along with the water, which thus washes the seat, at the instant of closing.

IMPROVED MIDDINGS SEPARATOR.

Edward T. Archibald, Dundas, Minn.—This invention consists in troughs arranged in one or more series above the reciprocating bolt, and in inclined gather boards arranged above the troughs and on each side of holes in the dome of the bolt, that lead into the fan chamber to guide the air and dust.

IMPROVED FLOUR BOLT.

William H. Woolard, Windsor, Ill.—This consists in providing a stationary auxiliary head, carrying a packing of sheep's pelt having the wool on, which is forced against the rotating head of the bolt reel by means of springs, and retained in place by leather straps. The object is to prevent the accumulation of dust on the bolt head, and to prevent the escape of specks and flour dust from the bolt, and also to do away with the device used in flour bolt chests commonly known as speck boxes.

NEW AGRICULTURAL INVENTIONS.**IMPROVED CULTIVATOR.**

Edward Nauman, Bridgeport, O.—In this cultivator, by moving one of the side standards forward and the central standard back, the machine is adjusted as a side wiper. By moving the center standard forward and attaching a larger shovel to it, and moving the side standards back, and attaching half shovels to them, the machine becomes a potato plow. By detaching the center standard and moving one of the side standards forward, the machine becomes a double shovel. By detaching the side standards, the machine becomes a single shovel; and by detaching the center standard, and attaching half shovels to the side standards, the machine becomes a corn coverer. The farmer is thus provided with a number of useful implements arranged in compact form.

IMPROVED CULTIVATOR.

Horace C. Briggs, West Auburn, Me.—Novel devices are provided whereby the ends of the beams may be moved wider apart or closer together, as may be desired. The points of draft attachment may also be raised and lowered as circumstances may require. The depth to which the plows enter the ground may be regulated and the machine may be easily guided around short turns in crooked rows.

IMPROVED RIDGE-FORMING MACHINE.

Andrew D. Martin, Abbeville, La.—This invention is a machine for forming ridges for planting sweet potatoes; and it consists in the combination of two plows and two rollers inclined with each other, so as to throw the soil toward each other to form a ridge. The upper ends of the two rollers incline toward each other; and as soon as the dirt has been heaped by the plows, the rollers press it together to form a steep ridge. The plows may also be used without the rollers, for ordinary ridges, such as for cotton, corn, or cane.

IMPROVED CULTIVATOR.

Edwin W. Joy, Iowa City, Iowa, assignor to himself, Marcus F. Dunlap, and Samuel J. Faust, of same place.—This relates to cultivators in which short independent axles are hinged to a yoke connecting the two axles, to allow horizontal oscillation of wheels relatively to the beams, and which are used without a tongue; and it consists of the application of another yoke in a manner to regulate the oscillation of the wheels and prevent them from cramping too much and binding against the beams.

IMPROVED CORN PLANTER.

Burton Hakes and Ellis Hakes, Marengo, Iowa.—The general construction is such as to drop the seed automatically and at uniform distances as the machine is drawn forward to enable the hills to be planted in accurate check row, and to throw the dropping mechanism out of gear when the opening runners are raised from the ground.

IMPROVED STALK PULLER.

Robert D. Brown, Austin, Tex.—This consists of jaws which grasp the stalks, and which are actuated by hand levers to lift the latter from the ground. The whole is mounted on a suitable carriage. The device was described and illustrated on page 358, volume XXXIV.

IMPROVED WHEEL CULTIVATOR.

Thomas R. Wallis, Egg's Point, Miss.—This consists of a novel contrivance of frames for coupling the body frame of a wheel cultivator to the short independent axles employed in machines for cultivating high plants. The frames are composed of elliptic plates and connecting bolts, the plates being fitted at the middle on the axles, so that they can be readily taken off and shifted higher or lower, for which a number of holes are made in the plates for the axle.

IMPROVED BEE HIVE.

Noah D. Hayden, Dallas, Tex., assignor to himself and Amasa O. Clapp, of same place.—The brood chamber has its top and front open; and the back is securely attached to the back of the hive, so that, by swinging one side of the hive open, the brood chamber may be swung out, giving convenient access to its open side. The inner side of the brood chamber is made detachable, so that it may be removed to give convenient access to the said brood chamber, and enable the comb frames to be easily separated and removed.

IMPROVED SEED PLANTER.

John H. Lee, Livingston, Ala.—This invention relates to an improved construction of a seed planter, designed to plant corn, peas, beans, rice, turnip seed, and cotton seed, either in hills or rows, as may be desired. The invention consists in the particular construction and arrangement of parts, in which an ordinary plow is fitted up with detachable seeding devices, and is adapted to independent use as a plow or a combined use as a seed planter, thus forming an efficient and economical implement for farmers who are possessed only of a single horse.

IMPROVED DRAIN FENCE.

Dr. William A. J. Pollock, Kinston, N. C.—The object of the invention is to provide a means for preventing live stock from crossing over from one field to another, in which there may be growing crops, when such fields are bounded by canals, creeks, or large ditches. The invention consists in a very strong, peculiarly constructed frame work, which is designed to be placed in the canal of the dividing lines of the fields, whether such division line be a fence or a second ditch at right angles to the canal.

NEW MISCELLANEOUS INVENTIONS.**IMPROVED FLUME.**

Samuel C. Dike and Sidney M. Brawn, You Bet, Cal.—This invention relates to that class of flumes or chutes which are used for conveying lumber, wood, etc.; and it consists of a sheet metal trough, made up of semi-cylindrical sections, supported on trestle-work or other suitable support, and provided at its upper end with a grating for separating the wood, lumber, etc., from the water.

IMPROVED HARNESS LOOP.

Duncan McMillan, Dodge Center, Minn.—This consists of a double metal loop fastener, adapted to fasten two loops in hame, breast, holdback, breeching, and other straps to rings and buckles, without sewing the strap loops, as they are commonly done.

IMPROVED BALANCE LINE FOR MAST HOOPS.

William E. Leighton, West Pembroke, Me.—This invention is intended to make the hoops run up easily with the sail, and consists in the lacing together of the hoops by lines equidistant to the sail rope, and attaching the lines by sheaves running along the mast to the jaw of the gaff.

IMPROVED GAS BURNER.

Charles Royle, New York city.—This burner is so constructed that it may be adjusted to regulate the flow of the gas, and consequently the light from the outside, without its being necessary to remove any part of the burner for this purpose. The invention consists in a cap spun in to fit upon the neck and top of the base, having holes formed in its upper part corresponding in number and position with the holes through the said base, and having its lower part spun outward to receive the cover and the ring plate, and to serve as a handle for adjusting it.

IMPROVED WATCH BALANCE.

August F. Curpen, Plymouth, O.—This invention consists of a mode of connecting the balance wheel to the staff, so that in case the watch falls the wheel will move on the staff by the shock, and be stopped by the plates of the watch, if the watch falls flat on its side, or by other plates provided for the purpose in case the watch falls on the edge. This protects the jewels from breaking, and saves considerable expense for repairs.

IMPROVED PLUG TOBACCO.

George H. Lyford, Brooklyn, N. Y.—The object of this invention is to furnish plugs of tobacco so formed that the brand, trade mark, name of manufacturer, etc., or other desired information may be readily applied to them. Tags of wood are imbedded in the body of the plug beneath the wrapper, the said wrapper being cut away over the middle part of said wrapper.

IMPROVED HOLDBACK FOR THILLS.

George Sell, East Randolph, N. Y.—A short tube is slipped upon each of the thills from its forward end. Another short tube fits loosely upon the first tube, so as to be easily slipped on and off the end of the thill. The rear end of the second tube rests against a flange of the first tube, and to said second tube is attached a keep-

er, for securing the holdback strap to it. With this construction, should the drawing device become detached, the outer tubes will readily slip off the forward ends of the thills, and the horse will be entirely disengaged from the vehicle.

IMPROVED OPEN SIDE THILL.

Conrad H. Matthiessen, Odell, Ill.—The object of this invention is to improve the construction of the open side thill for which letters were issued to the same inventor November 30, 1875, to prevent the harness being drawn to one side by the springing of the thill, and to enable the holdback straps to be more easily connected with the thill. To this end the thill is now made hook-shaped in front, and in the rear has a bifurcation reinforced with an intermediate brace, all in one piece.

IMPROVED ATOMIZER.

Frank E. Stanley, Auburn, Me.—This relates to such improvements in atomizers that they may be employed for finishing photographs in water colors, India ink, and crayon, and also for all kinds of shading in which color can be used in a liquid state. The invention consists in inserting an adjustable wire with pointed end into the liquid tube, to regulate the amount of liquid issued. A cap or hood with detachable nozzles, having varying orifices, admits the confining of the spray to a certain surface.

IMPROVED WATCH CASE SPRING.

Numa J. Felix, New York city.—The object is to provide for an improved spring, that may be fitted with but little trouble into any case, so as to facilitate the repairing of broken springs by any watchmaker in a short time. The invention consists of a bearing or bridge piece, with downward bent end posts that bear in perforations the steel spring, the posts being readily recessed to fit any case.

IMPROVED SPARK ARRESTER FOR STOVE PIPES.

Horace W. King, Richmond, Mo.—Holes through the pipe, above the water level, in a boiler attachment which surrounds its lower section, allow the steam to escape from the boiler into the pipe and extinguish the sparks. An air jacket surrounds the pipe above the boiler, with holes in the bottom to allow the air to enter. Vessels extend down into the boiler from the head, for holding the medicating or other substance to be discharged into the air by the heat of the boiler. Holes in the top of the boiler are provided for the escape of the vapor of the water, and receive ball covers when they are to be closed.

IMPROVED CORDER FOR SEWING MACHINES.

John J. Donahoe, New Orleans, La.—A trumpet-mouthed tubular guide is constructed in two parts, and joined together for keeping the tube closed. A double spring gage guides the cloth both above and below the holding plate of the tube, and there is a contrivance of the attaching plate for regulating the height of the cord guide. All are arranged with special reference to fastening a cord wrapped in a strip of cloth between two pieces of cloth, by sewing the edges of the cord-inclosing strip and the edges of the cloth together at the same time.

IMPROVED TAX AND INTEREST CALCULATOR.

Niels Larsen, West Point, Neb.—The invention consists in the combination of three concentric cylinders, which are movable independent of each other, and the two outer ones provided with openings, allowing portions of each cylinder to be seen. The cylinders bear numbers or figures, the inner cylinder representing hundreds, the middle one tens, and the outer one units. By properly moving the cylinders the tax or interest upon a given sum or amount will be exhibited through a stationary shield.

APPARATUS FOR THE GENERATION AND HYDRATION OF SULPHUROUS ACID GAS.

William Maynard, New York city.—This invention relates to apparatus for generating and hydrating sulphurous acid gas, and it consists mainly in the following features: First, constructing the pan for burning the sulphur with a conical bottom, whereby a large amount of heat is conserved and the sulphur burnt without subliming, as is the case in ordinary furnaces; secondly, in the peculiar construction of the furnace door, designed to secure ease of manipulation, safety, and other incidental advantages; and thirdly, in the arrangement of a water tank upon the top of the condenser, which both operates as a reservoir for the water fed to the condenser, and is a receiver for the waste gas and azotized air.

IMPROVED RIDING SADDLE.

John T. Gathright and James C. Watson.—The object of the invention is to form a more perfect seat for the rider without adding either weight or expense to the saddle, by making the cantle of the tree and the thigh puffs on the skirts form a continuous concave or hollow seat extending well down on the leg of the rider.

NEW HOUSEHOLD INVENTIONS.**IMPROVED IRONING APPARATUS.**

Henry J. Nott, St. Mary's, Texas.—This machine embodies nine novel contrivances, which cover nearly the entire mechanics of construction. The iron is attached to a carriage above the table, and is supported in rails so that it may be drawn forward and back by cords communicating with a crank. The table is pressed up against the iron by levers. Devices for fluting and other operations are provided.

IMPROVED FOLDING TABLE.

James M. Kimball, Woodstock, Ill.—This consists of an under frame pivoted to one of the middle boards, so as to swing around in line with it for folding, and crosswise of it for setting up the table, in which latter position it stands on two legs which support one end, and locks with the legs of the other end, so as to hold the table upright. There is a weighted hook for hooking the two sections of the table together.

IMPROVED KNOB ATTACHMENT.

William H. Gonne, Chatham, Ontario, Canada.—This invention consists of a spindle that connects the knobs and shanks, and binds the same tightly by a head at one end and screw nut, turning into the shank, and on the spindle at the opposite end. The roses are provided with spurred sockets to be attached securely to the doors. This admits the ready adjustment of the knobs to any thickness of door.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.**IMPROVED VEHICLE SPRING.**

William Hunt, Oskaloosa, Iowa.—To the upper part of the forward spring is bolted a circular block, which fits into a recess in a wheel, which is bolted to the middle part of the spring bar. The upper part of the forward spring and its disk are pivoted to the bar, and the flanged block by a bolt, which passes through the said parts, the blocks thus forming the fifth wheel of the vehicle. A spring brace bar, the rear end of which is secured to the center of the rear axle, holds the springs perpendicular. By this construction, when the vehicle is loaded so as to compress the springs and bring the brace into horizontal position, the parts of the spring will be nearly vertical, and thus in the most favorable position to resist a strain.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Agricultural Implements and Industrial Machinery for Export and Domestic Use. R. H. Allen & Co., N. Y.

For Sale—One Corliss Engine, in good order; cylinder 20 in. diam., 48 in. stroke. Apply to Kelly & Ludwig, 730 Filbert Street, Philadelphia, Pa.

Nicely drilled Index Pulleys, 5 in. diam., 3 in. face. Lathe Gear Cutting and Work Holder Attachments very cheap, to close out a lot. W. P. Hopkins, Lawrence, Ma.

Manufacturers of or Dealers in Tray and Bowl Turning Machinery, please send Descriptive Circular and Price List to C. H. Leffler, Elmore Station, Elmore County, Ala.

For Sale—State Rights of Patent Safety Horse Ropes; sells on sight. Address, for terms, etc., J. F. Riesgraf, care of Box 773, New York City.

Hill's Champion Clothes Dryer has taken every First Premium wherever exhibited. Arranged for yards and roofs. Great inducements to agents. Champion Dryer Company, 513 Main Street, Worcester, Mass.

Boiler Punch Lathes, 9 ft. Planer. Brooks & Winbrenner, 261 North 3d St., Philadelphia, Pa.

700 Imp'd Chromos, cheap. Box 29, Pittsburg, Pa.

R. H. Norris & Co., Steam Gauges and Silk Spool Measuring Machines. Paterson, New Jersey.

Fire Hose, Rubber Lined Lanes and Cotton, finest quality. Eureka Fire Hose Co., 13 Barclay St., New York.

Tool Chests filled with the very best tools are furnished by James T. Pratt & Co., 53 Fulton St., New York. Circulars sent.

Paper Pulley Cover to prevent Belts from slipping—Patent for Sale. Address J. de Vries, 114 Wooster St., New York.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocom & Son, Drinker St., below 147 North Second St., Philadelphia, Pa.

At a Bargain—Centennial Exhibition Shafting. Four lines of 2½ and 3 in., complete. 85 ft., 105 ft., 130 ft., and 170 ft. A. B. Cook & Co., Erie, Pa., or D. 9, 72, Machinery Hall.

Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability, are cheaper by comparison than any others extant. 346 Grand St., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

For 15, 16 & 18 in. Swing Engine Lathes, address Star Tool Co., Providence, R. I.

The Scientific American Supplement—Any desired back number can be had for 10 cents, at this office, or almost any news store.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

More than Ten Thousand Crank Shafts made by Chester Steel Castings Co., now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 285.

See Boulton's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 5-55. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Water, Gas, and Steam Pipe, Wrought Iron. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

Shaw's accurate and U. S. Standard Mercury Gauges, Steam, Vacuum, Hydraulic, and Test Gauges, &c., 215 Ridge Avenue, Philadelphia, Pa.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

Models for Inventors. H. B. Morris, Ithaca, N. Y.

M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 259 W. 27th St., N. Y.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water Street, New York.

Pat'd Graining Stencils—J. J. Callow, Cleveland, O.

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Driving Belts made to order, to accomplish work required. Send full particulars for prices to C. W. Army, 148 North Third St., Philadelphia, Pa.

"Dead Stroke" Power Hammers—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 20 per cent. Hull & Belden Co., Danbury, Ct.

Power & Foot Presses & all Fruit-can Tools. Ferracute Wks., Bridgeton, N. J. & C. 27, Michy Hall, Cent'l.

Steel Castings, from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For best Presses, Dies, and Fruit-can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

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For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon, 470 Grand Street, New York.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Shingle, Heading and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Notes & Queries

G. D. T. will find a recipe for waterproof glue on p. 43, vol. 32.—A. C. G. should use Indian ink for architectural drawings.—C. A. W. can French polish beechwood. See p. 11, vol. 32. To mend a rubber band, put a piece in with the cement described on p. 203, vol. 30.—F. S. will find directions for making baking powder on p. 123, vol. 31.—P. E. H. will find directions for transferring engravings to glass on p. 208, vol. 31.—G. S.

should consult a dentist.—W. T. B. will find directions for making hard soap on pp. 331, 379, vol. 31.—W. O. G. will find directions for cleaning shells on p. 122, vol. 37.—S. N. C. will find directions for browning gun barrels on p. 11, vol. 32.—C. P. can blue steel work by the process described on p. 123, vol. 31.—W. M. will find directions for silvering mirrors on p. 207, vol. 31.—W. P. will find directions for making a weather glass on p. 75, vol. 30.—P. K. D. will find that the pretended plated diamond is an imposition.—F. H. M. will find directions for softening iron for electro-magnets on p. 123, vol. 31.—H. S. B. will find directions for making Babbitt metal on p. 364, vol. 29.—C. A. H. will find a recipe for a hair restorer on p. 363, vol. 31.—D. A. H. will find complete instruction in the art of mechanical drawing in the SCIENTIFIC AMERICAN SUPPLEMENT.—E. R. G.'s plan for striking the curve of a segment of circle, the chord and altitude being given, is very old.—E. S., W. L. B. J. H., H. C. S., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) A. W. says: I have an achromatic object glass of 30 inches focus and 1½ inch aperture. I wish to know what eyepiece to use. A. You can use the one described on p. 315, vol. 34, or the one described on p. 203, vol. 35. 2. What advantage has an eyepiece with four glasses over one with only three? A. An eyepiece with four glasses can be better corrected.

(2) A. G. C. asks: 1. What power is necessary to drive two circular saws (1 cross cut and 1 rip) of 12 inches in diameter, in 2 inch pinelumps? A. About 4 or 5 horse power. 2. What size of boiler would be necessary to furnish steam for an engine 3x8 inches, running at 250 revolutions per minute, cutting off at about ¾ stroke. A. One with about 75 feet, superficial measure, of heating surface.—J. E. E., of Pa.

(3) A. E. R. says: What would be the dimensions of an air pump to work from an eccentric to give 80 lbs. pressure to the square inch in the shortest time? A. If you have plenty of power to drive the pump, you can get 80 lbs. pressure with a large pump as quickly as with a small one, if the action is direct. And in proportioning the size, you need only look to the total pressure which you wish to exert.

(4) E. D. G. asks: 1. If a balloon has, when filled with gas, a lifting capacity of 100 lbs., would it not have double that lifting capacity if twice the volume of gas could be compressed within its sphere? A. It would have less. 2. A balloon will ascend until it reaches equilibrium, or, in other words, until it reaches an elevation at which the gas and atmosphere are of the same weight. If by a safe process the gas could be heated, would not the balloon attain a greater elevation? A. Yes, if the balloon could expand.

(5) O. J. B. says: Please give me a method of producing the logarithmic spiral, and also state its use in mechanics. A. Draw a circle, divide its circumference into any number of equal parts, and draw radii from these points to the center of the circle. Then divide one of the radii into the same number of parts, increasing the length of the successive divisions, from the center, in geometrical progression. Transfer the points so determined to the successive radii, thus determining points of the spiral.

(6) R. M. B. says: Can a ladle or suitable vessel be made for melting 2 lbs. of iron in a common blacksmith's forge? If so, of what and how shall it be made? A. There are small plumbago crucibles made for this purpose. Metal ladles would not serve for this purpose.

(7) J. N. W. asks: 1. Who first applied steam power to the propulsion of boats, and is the inventor of steam navigation? A. The Marquis de Jouffroy, of France, used a steam engine in a vessel some years before Fulton. 2. Who first applied steam power to a locomotive on an experimental track, and is entitled to the credit of the invention of railroading? A. It is generally supposed that the first locomotive was built by Cugnot, in France, in 1769. 3. Who made the first rifled cannon? A. Rifled cannon were first brought into use in 1857. Doubtless many had been invented, and numerous experiments had been made, before that time. We cannot, however, state definitely who was the first inventor. Possibly some of our readers can answer the question. 4. Was not the Merrimack the first ironclad vessel ever used or invented? A. Ironclads were used by the French in the Russian war. In this country Captain Eads constructed several, which were in use before the Merrimack appeared.

(8) H. S. G. says: Suppose I pour a piece of cloth with 1 lb. sulphuric acid to 40 gallons water for the space of 3 minutes; if I use 80 gallons of water with 2 lbs. sulphuric acid, would the cloth absorb any more of the acid in the same time? A. If we understand you, no.

(9) J. T. P. says: I visited the Girard College, Philadelphia. An attendant told me that the spiral stone steps were almost self-supporting, or brace themselves about the same as an arch of a bridge. I have spoken about them to a number of friends; they say that the steps run in the wall about 3 feet, while the attendant said that they rested in the wall only about 2 or 3 inches? Was he right? A. The steps are supported essentially on the principle of the arch. They have, in addition, a direct support upon the front edge and on one end of each step; a single step cannot fall without turning over backwards, but this is prevented by the weight of the wall upon one end of it. A very little compressive strain, therefore, upon the arch joints, which are at right angles to the under side or soffit, is sufficient to hold it firmly. See Nicholson's "New Director," edition of 1854, plate XIV, for a similar stairs.

The steps are also doweled together with iron dowels, which bind the whole together.

(10) B. F. T. says: Are principles established which show the exact or geometric trisection of any angle (except a right angle) to be impossible? A. The construction can be made for any angle, but the strictly geometrical solution is said to be impossible, because the construction cannot be made by the aid of straight lines and circular arcs alone.

(11) L. C. asks: How can I secure dry walls in the basement of my house? The plastering does not dry. A. It is caused probably by the plastering having been put upon the brick or stone wall without the intervention of furring. It is usual and necessary in such cases to plaster upon lathing nailed to wooden strips placed vertically upon the face of the wall at every 12 inches. This secures the plastering, both from any dampness that may come out of the brick or stone wall, and (by preventing the brick from reducing its temperature) from the condensation of water out of the air of the room upon its surface, either of which is sufficient to destroy it. We cannot suggest any remedy short of the replastering upon lath as here described.

(12) C. F. S. asks: How large a boiler will it require to run a 3½ inch stroke boat engine? How large a wheel and how long a boat will be required? How fast would the boat go? A. It is impossible to answer this question definitely, as you do not state the diameter of cylinder. This answer applies to several other queries.

(13) H. & B. say: In our cooling room, temperature is 42°; when the door is open, it will rise to 50° and fall again. We complain of wet walls, dripping of ceiling, cold damp air, and melting of ice. How can we obtain a cold dry air? A. The dampness arises from the precipitation of water from the air in cooling, and there may be some leakage from the ice melting above. A more free circulation of air would reduce the dampness, but at the same time increase the temperature. The ice would keep better in a compact body; but we must allow that the air can be cooled only by a sacrifice of the ice. A good cooling room is made under the mass of ice and with an air passage around the sides; in this case the doors are not opposite one another, but open upon the passage at different points. When the ice is used also for other purposes, 12 feet cube is a good size for the body of ice. In this case it will keep for two years.

(14) W. T. says: The length of a pendulum which vibrates once an hour is very nearly the diameter of the earth. Does a similar relation exist on other planets? A. No.

(15) G. W. B. says: We wish to build a house 30 x 34 feet, of 3 stories, 26 feet high in all. How shall we construct hollow walls so as to make them damp-proof, and what thickness shall we make the walls? A. Make the wall 14 inches thick, that is to say, the inside wall upon which the door joists rest 8 inches thick, the outside wall 4 inches thick, and the vacant space between them 2 inches wide. These two divisions of the wall should be tied together with anchors made of hoop iron or other light iron, or with cross ties of the brick itself, at about every 4 feet in height of the wall, and say 5 feet apart, set in rows and alternating one above the other.

(16) W. E. S. asks: Can I construct a horseshoe or U-shaped electro-magnet, by tempering so that it will keep its magnetism after the circuit has been broken for about a half or a minute, more or less, as desired? A. If you make your magnet so that it will retain magnetism for half a minute after the circuit is broken, it will retain the magnetism permanently. There is no halfway work about it. It either holds its magnetism permanently, or gives it up immediately the circuit is broken.

(17) E. P. S. asks: How can I make a cheap telescope, which will show the rings of Saturn? A. Take a plano-convex lens of 1½ inches aperture and about 5 feet focus; place the flat side against the end of a tube a little less than 5 feet in length, into which slides another tube. To the end of the small tube fasten the eyepiece, which may be either a double convex or double concave lens of about 1 inch focus. The double convex lens gives the largest field, with the image inverted; the other shows the object erect and gives better definition.

(18) W. G. W. says: 1. A body weighs more at the poles than at the equator. Is any part of the increase in weight due to its being nearer the center of the earth? A. Yes. 2. I think that a person starting at the north pole, and going in any direction, must go south. Is this so? A. If it were a true pole, and his course were limited to the surface, we think your proposition would hold.

(19) H. H. M. says: 1. I wish to ask some questions as to the ice house described on p. 251, vol. 31. "Provide a good drain in your icehouse to carry off the water." If I build my icehouse on level clay ground, will a dry well suffice for drainage, and if so, how large and deep should it be? A. Yes, if located outside of the building. Make it 6 feet in diameter and 6 feet deep, conical, with base at bottom. Provide an opening at top, covered with a stone, so that you can empty it when necessary. 2. "Put a high-pitched roof over the ceiling." Are the ceiling and roof to extend over the exterior wall, and is the roof to join said wall so as to exclude the air from the space between the interior and exterior walls? A. Yes; the roof is to cover every part of the building, and should project well over the eaves. 3. "Make doors lined with canvas." Do you mean that canvas is to be substituted for boards on inside and outside of doors, and why? A. The doors are to be made as thick as the walls in which they are placed by being padded out upon the inside with

canvas filled with sawdust; this is to make them lighter for use than boarding would be. 4. In a space 6 feet square and 8½ feet high, how can you have "a cube of ice of 7 feet?" A. This was an error of the types; you will find it corrected in No. 41, p. 188, vol. 35.

(20) H. D. T. says: A friend of mine, in attempting to alight from a moving train, stumbled, fell, and received some bruises about the face; the latter healed up, but left dark spots caused by coal dust. He was advised to blister, and did so, keeping the blisters open for a week. All this did not improve the appearance perceptibly. Can anything further be done in this case? A. Probably nothing short of a surgical operation will remove the spots.

(21) J. O'B. asks: How can I keep oriole of gold from being discolored? A. The so-called oriole gold is a variety of brass. If kept well lacquered, it will not discolor.

(22) O. R. asks: If a piece of Babbitt metal, weighing 25 or 30 lbs. and containing antimony, be placed in a well, would it hurt the water for house use and drinking purposes? A. Under certain circumstances, it would prove injurious.

(23) F. W. W. asks: Why, when alcohol and aqua ammonia are mixed in about equal parts, does the liquid turn a light red? A. If the reagents are pure, this change does not occur.

(24) M. V. W. asks: How can I clear sirup of sorghum and molasses? A. The sirup is neutralized with a little lime water and filtered while hot through bone black, which clarifies it perfectly.

(25) W. C. B. asks: How can I remove verdigris from apple butter? A. You cannot remove it without injury to the butter.

(26) W. asks: How is benzine, such as is sold for cleaning clothes, prepared? A. It is one of the direct products of the distillation of petroleum (specific gravity 60° to 70° B.). It is an intermediate between naphtha and kerosene.

(27) O. J. C. says: A case of poisoning by Paris green happened a few days ago, and there is some controversy among the physicians as regards the proper antidotes which should have been applied. A. Give recently precipitated moist ferric hydrate, best administered in the form of a solution of perchloride of iron with magnesia. Emetics should also be given, and the stomach pump applied. Carbonate of soda is sometimes made to replace the magnesia wholly or in part. 2. What is Paris green made of? What are its proportionate ingredients? A. Paris green (Schweinfurt green) is the aceto-arsenite of copper: $(C_2H_3O)_2As_2O_3 + 3CuO, As_2O_3$. In 100 parts oxide of copper=31.29; arsenious acid=58.65; acetic acid=10.06. 3. In what respect does Paris green differ from Scheele's green? A. Scheele's green is the arsenite of copper, CuO, As_2O_3 .

(28) W. H. asks: At what speed ought I to run my water wheel, which is an overshot of 15 feet diameter and 5 feet face, economy of water being the desired object? A. At between 6 and 7 revolutions per minute.

(29) E. L. G. asks: 1. Can copper be nickel plated? A. Yes. 2. How can I plate a rim about the size of a pall hoop? A. Use nickel salts and insert the rim to be plated in the bath and proceed as in plating with other metals.

(30) J. B. asks: 1. Will electricity, passing through a magnet, change its poles? A. It can be made to do so. 2. Take 100 magnetic needles, fasten each to a piece of small wire, say 2 feet long, and these with the magnets attached to a single wire 5 feet long; now will a strong current of electricity, passing through this wire, change the poles of all these magnets? A. No.

(31) J. C. W. says: We have had a discussion on the merits and demerits of upright and horizontal engines and boilers. Is there much difference as to the durability and efficiency of either when the same care is taken of them? A. Not much, but it is a little in favor of the horizontal engine. 2. What kind, upright or horizontal, would you advise for six horse power? A. A horizontal one.

(32) H. A. P. asks: Are cast iron turnings as good for a ground connection for a lightning rod as wrought or scrap iron? A. Yes. You cannot err by having too much surface exposed to the wet ground; and the more iron turnings you use, the better.

(33) E. M. asks: 1. What size and how much of silk-covered wire do I need to make an electro-magnet capable of lifting a weight of 1 oz.? The cores are ½ inch in diameter and ¾ inch long. A. Cover your core with No. 20 cotton-covered copper wire to the thickness of ¼ of an inch. 2. What kind of a battery, and how large, must it be? A. Use two cells of Lockwood's battery.

(34) E. S. asks: Can you give me a formula for reducing the area of a pipe in feet to its diameter in inches and decimals of inches: that is to say, if the area of the pipe is 0.063 feet, then what is its diameter in inches? A. Divide the area in square feet by 0.7854, extract the square root of the quotient, and multiply the result by 12.

(35) C. asks: What pressure per square inch will first class steel pipes stand, ¾ inch outside diameter, ¼ inch thick, making ½ inch inside diameter? A. The bursting strain per square inch would be about two fifths of the tensile strength of the material.

(36) A. D. S. asks: If the ancients believed that the world was flat, why is Atlas always represented as carrying a globular world? A. According to some legends, Atlas was a great philosopher who was the first to teach that heaven was in the form of a globe.

(37) T. J. S. says: Please give us a recipe for a cement that will resist the action of alcohol. A. Melt together equal parts of pitch and gutta percha. Apply hot.

(38) J. A. C. asks: Please name a substitute for lime in a washing compound of sal soda and lime, as the lime will not keep. A. We do not see that the introduction of lime, or any substitute similar in properties, is requisite. A solution of subcarbonate of soda (sal soda) in water is all that is required. The following recipe has lately been introduced in large laundries; it is of German origin: The clothes are simply boiled for about half an hour, with occasional stirring, in water containing about half a pound of common hard soap, ground fine, and 2 ozs. spirits of turpentine to the gallon. The clothes, after rinsing as usual in clean water, and drying in the air, do not retain the slightest odor of the turpentine.

(39) A. R. L. asks: Is there any acid used in the manufacture of sirup? Is it injurious, and how can I detect the presence of it? A. If you mean grape sugar sirup, yes, sulphuric acid; but it is all removed by lime. Test a small portion of the sirup with a solution of chloride of barium; the clouding of the solution indicates the presence of sulphuric acid.

(40) R. L. C. says: I have made an ink by mixing 5 gallons water, $\frac{1}{2}$ lb. logwood, $\frac{1}{2}$ oz. bi-chromate of potash, and $\frac{1}{2}$ oz. prussiate of potash, but this ink will not mix with other inks. Why if this? A. Ordinary ink contains gallate of iron, which is precipitated as Prussian blue on the addition of any mixture containing an alkaline ferrocyanide. At the same time a portion of the chromate suffers decomposition.

(41) P. J. B. asks: What substance will remove the gloss from a black coat, so that it will not immediately reappear? The shiny appearance is probably caused by its rubbing against the back of a wooden seat in a horse car. A. Sponge it regularly with a soap containing considerable alkali. If this does not succeed well, use benzole.

(42) W. W. A. asks: Is there anything injurious in paraffin wax, if mixed with bread? A. There is not, but paraffin is not desirable as food.

(43) T. L. M. says, in reply to M. H. C., who asks if a point on a connecting rod between the centers of the crank pin and crosshead journal describes a perfect ellipse, or if the figure it describes is slightly larger at one end than at the other: It describes a perfect ellipse.

(44) F. M. P. says, in reply to G. S. P., who asks about artificial egg hatching: Last spring, there were hundreds of chickens hatched in a box 2 feet square by 6 feet long, set on end. The upper half was full of frames like sieves, frames covered with canvas; these were 4 inches apart, on slides. They were filled full of eggs, and at the bottom of the box was a coal oil lamp burning; directly over it was a pan with water in it to keep the air damp. The operation was watched, and the eggs were turned every day.

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

J. D. B.—It is red jasper.—F. D. B.—All four are flint, containing different percentages of iron.—J. B. H.—It contains about 20 per cent of iron.—H. C. B.—They are crystals of sulphate of lime.—O. H. J.—No. 1 is spiegleisen. No. 2 is flint. No. 3 is decomposed mica.—J. B.—It is compact quartz rock. The small percentage of iron contained in it may hurt it for the purpose proposed.—J. H. P.—No. 1 is fibrous selenite. No. 2 is iron pyrites. No. 3 is hornstone. No. 4 is milky quartz. No. 5 is ferruginous quartz. No. 6 is quartzite. No. 7 is shale. No. 8 is gypsum. No. 9 is iron sandstone. No. 10 is crystallized selenite.—W. M. B.—It contains sulphuric acid, chloride of sodium, carbonate of lime, and a great amount of organic matter. Add lime water, boil, and filter through gravel, sand, and charcoal.

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 Analogy of Light, Heat, etc. By S. A. C. On a Lusus Nature. By J. H. P. On Spiritualism, etc. By C. A. W. On Railroad Rails. By P. M. A. and others. On Flying Machines. By C. C. M.

Also inquiries and answers from the following: J.—T. L. R.—H. S.—H. W. C. T.—C. A. S.—B.

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.

Hundreds of inquiries analogous to the following are sent: "Who makes Japanned tin novelties and toys? Who makes watchmen's time detectors? Who makes spring balances? Who manufactures India rubber?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

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September 26, 1876,

AND EACH BEARING THAT DATE.

(Those marked (r) are reissued patents.)

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DISCLAIMER FILED.

61,171.—BINDING FOR SKIRTS.—Thomas B. De Forest, Birmingham, Cal.

DESIGNS PATENTED.

9,501.—CLOTHES-DRYERS.—H. P. Roberts, Tunkhannock, Pa.
9,502.—STATE BASKET.—B. F. Tutill, Burlington, Vt.
9,503.—FOUNTAIN.—W. Tweeddale, Brooklyn, N. Y.
9,504.—EMBROIDERY.—E. Crissand, New Haven, Conn.
9,505.—FENCES.—A. Smith, Monticello, N. Y.

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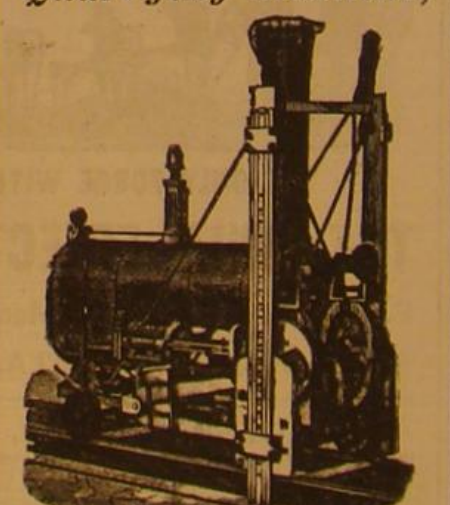
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DR. TAYLOR VS. PROFESSOR HUXLEY.

As a rule, it is a waste of time to pay any attention to the excursions of any man into unfamiliar fields of knowledge, however great his reputation for learning may be in other directions. A man may be an authority in Hebrew history, yet densely ignorant of the events of mediæval Europe. He may be chief among chemists, yet a beginner in biology, and entirely out of his element in mechanics. When such a specialist attempts to settle questions in departments other than his own, he is pretty sure to accomplish little else than the exposure of his own lack of knowledge. Even more certain to go wrong is the man who ventures into a field of knowledge in which the means and methods of study, the kind of evidence, the spirit of investigation, and the purpose of the work are each and all unlike those he is used to. The mental habits of the trained theologian, for example, are quite the reverse of those of the trained scientist. The one proceeds, calmly, dispassionately, and sensibly, to investigate actual existences, conditions, relations, and occurrences. The result may be more or less advantageous to him and to his fellows; but he is not personally responsible for it, whatever it may be, since no one can justly blame or punish him, here or hereafter, for finding things as they are. The theologian, on the contrary, deals with matters of emotion, aspiration, fancy. His materials are ever varying feelings and equally unstable imaginations. His things are words, often from languages vaguely understood, or technical phrases concerning the import of which there is no agreement. And the issues at stake are of transcendent importance—infinitely felicity or eternal woe to such as assent or deny. To him authority, human or divine, is everything: tradition is almost omnipotent, and the penalty of independent thought is excommunication, the alienation of friends and associates, and, mayhap, personal damnation. And he naturally carries with him the same habits of thought, the same incapacity for unprejudiced and impartial investigation of realities, the same inability to appreciate the logic of facts, whenever he enters the scientific field as a self-elected umpire or dictator. Consequently his utterances therein are pretty certain to be valuable only as so many additions to the already over-abundant supply of illustrations of learned foolishness and of the uselessness of metaphysical methods for the advancement of real knowledge.

These remarks have been suggested by the labored attempt of the Rev. Dr. W. M. Taylor to break the force of Professor Huxley's lectures on evolution. Dr. Taylor is a gentleman of considerable eminence in the theological world: but that only makes the more ludicrous his Quixotic attack upon a purely imaginary Professor Huxley, in the course of which he exhibits an utter misapprehension of the scope and purpose of the real professor's remarks, and the most thorough-going ignorance of the range, amount, and quality of the evidence bearing on the question of evolution.

He is off the track from the start, assuming that Professor Huxley pretended to give a demonstration of the hypothesis of evolution, and that his lectures contained all the evidence to be produced in its support. The single fact that Professor Huxley promised no more than a popular illustration of certain lines of evidence bearing more or less distinctly and forcibly upon the hypothesis of evolution, and directly declared that it was no part of his purpose to enable any one to pronounce upon the truth or falsity of the doctrine, sufficiently proves the irrelevancy of four fifths of the pretended criticism. Professor Huxley did not promise nor attempt to "demonstrate" evolution, but merely to indicate the kind of historical evidence the theory demanded, and how geology was meeting the demand. To have recited all the evidence of this sort in the possession of Science would have required weeks or months instead of hours; while the evidence derived from existing conditions and relations in the world of animal and vegetable life would require an allowance of time not less liberal.

The remaining fifth of the two columns of the *Tribune*, which Dr. Taylor devotes to the destruction of the theory of evolution as Professor Huxley did not present it, comprises a curious array of misstatements, misconceptions, and absurdities, which we should like to traverse at length, but can merely sample for lack of space. No better evidence could be asked of the reverend doctor's incapacity for the task he has undertaken than is found in the following assertion, which may be a misapprehension, but certainly is a misstatement of the most ridiculous character. He says: "He (Professor Huxley) allows that species are persistent, and that there is little or nothing in the geologic records that sustains his position!"

After that, the reader will not be surprised at the assumption that the diversity of interpretation, "marvelous flexibility," etc., of Genesis is confined to the meaning of the word *day*; or that Professor Huxley craftily avoided the "fourth hypothesis" of creation—that is, creation in series, or successive creations in time—in spite of his positive exclusion of that view as unworthy of attention, it being unsupported by evidence of any kind, either scientific or scriptural.

But all these are as nothing, compared with the triumphantly funny demand: "If evolution rests on a basis as sure as astronomy, why do we not see one species passing into another now, even as we see the motions of the planets through the heavens? Why cannot its votaries foretell that, at a certain time and in a certain place, not too far from personal inspection by us, some modification in the structure of an animal or a plant shall occur, without any human intervention, even as astronomers predict the occurrence of a transit of Venus across the sun?"

Yet the man who is capable of perpetrating such a grand absurdity—absurd in what it asks, as well as in what it denies—really believes himself competent to pass upon a prob-

lem involving a vast amount of natural knowledge and no small degree of natural intelligence. And doubtless there are not a few who will accept his flourish of misplaced logic as conclusive against evolution, and rejoice with him that Professor Huxley's "imposition" has thereby been nailed to the counter "that it may not get into currency."

IRON AND STEEL WORKING IMPROVEMENTS.

We give in our this week's SUPPLEMENT a full abstract of a recent paper read before the Iron and Steel Institute, at Leeds, England, on the Haswell system of forging iron by hydraulic pressure, by Mr. J. O. Butler, and of the interesting discussion which followed. Much valuable practical information concerning iron forging was elicited. Among the speakers was Sir Joseph Whitworth, who gave some remarkable particulars concerning his operations in compressing molten steel. He stated, among other things, that he had lately completed a pair of steel screw shafts for the ship *Inflexible*. They were 283 feet long, weight 63 tons. A weight of 97 tons would, ordinarily, have been required; but by the compression of the molten steel, a saving in weight had been effected of 34 tons. In practice the fluid steel is subjected in the mold to a pressure of six tons, or 12,000 lbs., to the square inch.

This week's SUPPLEMENT also contains abstracts of papers, read before the Institute, on the "Straightening and Planishing of Round Bars," a process by which the scale, instead of being rolled in, is removed, and a smooth, clean surface produced, the bars being as finished and straight as if turned in a lathe.

Also an interesting paper on the "Utilization of Blast Furnace Slag, with its Heat, for the Manufacture of Glass." It appears from this paper that, by the addition of a few simple chemicals and apparatus, it is practicable to connect the profitable manufacture of glass with iron furnaces without in any manner interfering with the usual continuous operations of the blast furnace: the heat now lost being successfully applied to the production of the glass.

SOME THOUGHTS ON LABOR.

We have recently perused with much interest a little work entitled "Talks about Labor," written in a pleasant colloquial strain by Mr. J. N. Larned, of Buffalo, N. Y., in which the labor question is dealt with, in some respects, in a novel manner. The writer's main point is that political economy alone is not capable of dealing with the labor question, that the relations of capital and labor cannot be adjusted by abstract theorizing, but that the problem is constantly complicated by human needs, misfortunes, and passions, which must be considered. "We eke out now," he says, "a tyrannical and heartless theoretic economy with practical charities and generousities which make it tolerable. The change to be brought about is this: that we must reduce the generosity to a system, not of generosity but of justice in right." This, in the main, is but another form of expression for the counsels of moderation and regard for the rights of others that we have hitherto offered in considering cases of labor troubles; for we have long been persuaded that an equitable and permanent adjustment of the difficulties existing between employers and employed is to be reached, not by measures of coercion between the contending parties, or by like heroic treatment, but through the slow but sure judgment of society, brought about through the perception of the mean to which moderate action and opinion on both sides must approximate.

We cannot here follow the author through the various arguments which spring from the above proposition, and therefore at once pass to the remedy which he thinks likely to be most effectual against the strikes and lock-outs of the future. And this is a kind of limited coöperation between employers and employed, in which a system of dividends out of the profits is introduced to supplement the wages system. Then, it is urged, the working classes would begin to observe and apprehend the phenomena of the market out of which the laws of industrial economy are derived, and consequently would be inspired, from personal motives, to act in coöperation with the managers of capital. The idea so far is not new; and while we are by no means prepared to assert that it may not be practicable, past experience furnishes many instances of unsatisfactory results in its working. It was introduced in England by Messrs. Briggs & Son, of the Whitwood collieries, in 1865. This firm organized a limited company, and the men were made partners in the prosperity of the concern to a certain fair extent. The project met with the warmest favor from such men as John Stuart Mill and Thomas Hughes, but the workmen were dissatisfied with their gains, and it fell through. Samuel Smiles, in a recent work, says that the firms of Greening & Co., Manchester, and Fox, Head & Co., of Middlesborough, in the iron trade, also admitted their men to partnerships in profits. The latter firm started on this plan in 1866, and after nine years' trial the system was abandoned, last year. Sir Joseph Whitworth has announced his intention of testing the scheme, but his results, if any, are not known to us. Generally, however, so long as profits are large the men are contented; but when the market falls and gains are reduced, then the aggregate returns are still expected to remain at former figures. In the case of Fox, Head & Co., the unions kept forcing wages higher as profits decreased, until finally a successful demand for twenty per cent increase resulted in the abandonment of the plan.

Not long ago, a case came under our immediate observation where the men in a large factory deliberately forfeited a dividend, amounting to some ten per cent of the profits of a considerable period, and due within a few days, in order to

join their craft in a strike. Their action, as it was evident would be the case, resulted in failure, and they returned to work at the old wages minus any share in profits whatever.

Perhaps, however, if we couple with the cooperative plan the reforms which, the author points out, might be made among the trades' unions, the attainment of the desired result would be more probable. Mr. Larned's picture of the trades' unions of the future is an agreeable one. They might "take upon themselves the responsible guardianship of all the interests of the mechanic industries, each its own, fixing and maintaining a high standard of workmanship for every trade, graduating the mechanics in their several arts, and conferring diplomas and degrees as the colleges do, with such strictness and fairness that the classification of the union or guild would be recognized in the labor market: opening their doors to all new comers widely, without any bars except such as these standards of proficiency will set up, and aiming to individualize—not generalize—the compensation of labor in each department of work by individualizing the labor itself: looking always to the efficiency, the skill, the productive value of each man's work for the basis of the apportionment of dividends to him from the production to which he contributes." If this, we fear Utopian, outlook could be realized, that the trades' unions would become "institutions of splendid usefulness," there is no room for doubt.

One portion of Mr. Larned's work which will be read with especial interest is an excellent showing of the enormously increased and increasing productiveness of labor through the progress of invention of labor-saving machinery. From statistical data gathered by Dr. Engel, of the Prussian Statistical Bureau, relative to the aggregate steam power in use in the world, there are some 3½ millions horse power employed in stationary engines, and 10 millions in locomotive engines. All this is maintained without the consumption of animal food except to the extent of the food of the miners who dig the coals; and the force maintained in their muscles is to the force generated by the product of their labor as 1 to 1,000 at most. This steam labor force is equal to the working force of 25 million horses, the theoretical horse power being about equivalent to the working power of two horses; and relatively to the producing capabilities of the soil, each horse consumes three times as much food as a man. To put steam power, therefore, in the place of 25 million horses is equivalent to a saving of food for about 75 million human beings more than could otherwise be fed from the same area of soil, under the same state of cultivation. Thus the stock of products of the soil which remains for division among human producers is enormously increased.

Now, we may consider the immense variety of work done by this steam power, and we may add to it the labor of water power, which consumes even less than steam of the earth's products. These vast forces enable man to do from five to a thousand times the quantity of work that he could with his unaided hands. Again, the improvements in mechanical devices yield a colossal gain of product from a given quantity of human labor employed as auxiliary to machines. Take the power looms, three of which machines, making cotton goods and attended by one man, can produce daily 78 pieces of fabric, 29 yards long and 25 inches wide; whereas on the old hand loom of 1800 one man working one loom produced only 4 pieces. In the spinning or weaving of woolen and fine fabrics, the production is multiplied fully tenfold; the sewing machine has produced like results in the manufacture of garments, and thus one of the primary wants of man, his clothing, is gratified by one tenth the human labor required half a century ago. In the matter of shelter, house building, modern woodworking machinery has revolutionized the carpenter's trade. A planing machine does the work of twenty men. In agricultural labor McCormick's reaper alone doubled the grain production in the Western States, simply by enabling the available labor of those regions to harvest the crop which the land was capable of producing. Taking into consideration all the gain in productiveness of the last century, it appears that the labor employed in Europe and America is now producing at least six times as much as the same number of laborers could have produced a hundred years ago: or to state the fact differently, only one man need work now where six worked a hundred years ago to produce the same supply for the satisfaction of human wants to the same extent.

SPIRITUALISTS' FACTS AND REAL FACTS.

We have received a polite request to reprint two brief extracts from our issue of September 2. The first, from the editorial "Is Anybody Sane?" runs in this wise:

"Men smitten with the disease cease to be amenable to reason in all matters connected with spiritualistic delusions. The most patent and ridiculous of frauds and follies, reputedly involving spirits and their mediums, are accepted by them with religious enthusiasm."

The second extract is from the letter of a correspondent, and carries, we are told, an emphatic censure of the foregoing, a censure requiring the most liberal use of italics and capitals to do it justice. We give it without such typographical assistance. Here it is:

"It (the law of gravitation) has been attacked in some quarters even by persons of education, and doubts have been thrown upon its teachings. This was done by the great German poet and philosopher, Goethe, among others; but he was simply ignorant of the facts. Every man judges about things according to the amount of information in his possession; and if Goethe had been informed of the manifold facts verifying this theory, he would surely never have attacked it."

If nothing had been said about censure, we should have

taken this communication as a kindly apology for the spiritualists, as people who mean well but are ignorant of the overwhelming evidence against the genuineness of reputed spiritual manifestations and the reasonableness of their theories of spirit existence and action. But censure implies at least a suspicion of error or wrong-doing; and we can see no call for it, nor any indication of it, in the present case, unless our correspondent wishes to insinuate that, as some well meaning people disputed the law of gravitation through ignorance, so we have been condemning, through ignorance of spiritual things, a theory as well supported by verified fact as the law of gravitation is.

If such is the case, we beg to assure him that we have taken pains to enquire into a good many cases of alleged spiritual manifestation of the objective sort, and have failed to discover anything to justify the spiritual hypothesis. On the contrary, every case which has been subjected to real scrutiny has been demonstrated to be a more or less clever fraud, abetted by a positive delusion on the part of the receivers of it; and the probability is overwhelming that the untested cases—if there are any—are of like character.

This is especially the case with objective manifestations. The subjective manifestations, and they are probably the more numerous, are less easy to dispose of, since there is nothing real to bring to light. These involve neither physics nor fraud, but disease. The actors are honest—but insane. Taken in time, a few doses of strychnin and iron, or other nerve tonics, will remove the symptoms promptly and completely. Allowed to become chronic, the disease may, and generally does, run the regular course of ideational insanity.

The unhappy naval apothecary who committed suicide at a pleasure resort the other day—or, as he thought, followed his adored Pauline to the spirit world—is a case in point. The spirit of Pauline which beckoned him onward was as real to him as his own existence; and he could not resist her entreaties to leap the gulf. No reason could convince him that the vision was not his wife's spirit: no, not even the circumstance that his beloved wife was still in the body. Precisely as trustworthy, precisely as convincing to the same mind, is the testimony of anyone else to the existence of the spirit forms he sees and converses with. It is all craze, where it is not fraud.

A pretty example of fraudulent manifestation is the one exposed in the person of Mrs. Hull in Portland, Maine, the other day. This lady, whose character forbade suspicion, was astonishing believers and unbelievers alike with spirit materializations, under circumstances in which collusion or deceit seemed impossible. In any room in any house, she would stretch a curtain across a corner, retire within the three-cornered enclosure, and, in a little while, "spirits" would come out from behind the curtain, move about the dimly lighted room, speak to the awe-stricken witnesses, and otherwise conduct themselves (one by one) like standard ghosts of good breeding. All this time the medium was supposed to be entranced within her little enclosure: and to make sure that she did not stir, her dress was exposed under the curtain, sometimes drawn out several inches and tacked to the floor.

The spirits triumphed for months, to the great strengthening of such as were in the faith and the serious confusion of the doubtful. But exposure came at last—as it always does, sooner or later. An unbelieving doctor won the medium's confidence, and betrayed it before a number of the ungodly assembled for the purpose of bearing testimony to the medium's discomfiture. By tender entreaties he induced the visiting spirit to trust her hand in his, then held it till lights were struck, and Mrs. Hull stood an unwilling prisoner, a convicted fraud. A little pile of garments in the corner betrayed her method. By sheer audacity she had deceived the very elect with the most honest-seeming materializations that have been exhibited thus far.

"But suppose Mrs. Hull was a fraud, like Katie King and others," our correspondent will probably reply: "that is no proof that spirit appearances are all fraudulent."

True enough: but the unexposed are relatively so few that the presumption—the drift of positive evidence—is decidedly against them. And the circumstance that in every instance the exposure of fraudulent mediums has been made by unbelievers shows the utter incompetency of believers to distinguish deceptive mediums from the genuine, if such there be: in other words, their testimony, however trustworthy in other regions of observation and experience, is good for nothing in this. As we have said before, they are the victims of delusion and mentally incompetent of sound judgment in matters involving their delusion.

Of course we do not imagine that our correspondent, or any like him, will be at all affected—otherwise than displeased—by what we have said. The most courteous reply they can make is that it is our craze, delusion, or what not, to be unable to appreciate the "facts" verifying the spiritualistic theory. We confess the failure: and until we are able first to verify the "facts" (or at least to find out one spiritualistic fact verifiable as neither fraudulent nor foolish) we shall not feel like subscribing to the theory, or even like discussing its probability.

And just here is where we differ from those who disputed the theory of gravitation. They disputed, or wilfully remained in ignorance of, an enormous mass of evidence verifiable by instrumental and mathematical means, evidence that could be verified every time by believers, unbelievers, and the indifferent, alike: evidence, too, which no other theory so easily, simply, and completely satisfied. We, on the contrary, refuse to accept the spiritualist's interpretation of a mass of facts, so called, the most of which have been proved fraudulent or delusive, over and over again; while

for the small residue of fact which may be verified, the spiritualist's hypothesis is inadequate, inconsistent with the rest of our knowledge, and enormously difficult of comprehension.

NEW CHEMICAL TEST FOR ALCOHOL.

Professor E. W. Davy, of Ireland, is the author of a new and very delicate chemical test for alcohol, which promises to be of much practical utility. The substance he uses is a solution of molybdic acid in strong sulphuric acid. When alcohol is brought into contact with this solution, a deep azure blue color is quickly developed. The test is so delicate that the presence of alcohol, in so small a quantity as the one thousand six hundred and sixty-sixth part of a grain in a drop of distilled water, is at once revealed.

The new test will be useful in detecting frauds in the preparation of various medical and chemical substances. For example, pure chloroform, owing to its high price, presents a temptation to fraud, and is often adulterated with cheap alcohol. The consequences, to the sick, are apt to be deplorable, sometimes fatal. By the new test, if there is so small a quantity as one part of alcohol in one thousand, in the chloroform, the presence of the alcohol is at once made known. Professor Davy's interesting paper is given in full in our SCIENTIFIC AMERICAN SUPPLEMENT, No. 46, and will be studied with interest by chemists and druggists.

PETROLEUM CHANGED INTO ELECTRICITY AND LIGHT.

Professor W. A. Anthony, in the course of a recent series of experiments with an electro-magnetic machine of the Gramme pattern, made the following interesting observations:

The electric machine was driven by a five horse Brayton petroleum oil engine (illustrated in SCIENTIFIC AMERICAN, page 803, volume XXXIV). The engine consumed a little over six and a half lbs. of crude petroleum per hour. The lamp used in the engine, by which the explosive mixture is fired, had a one inch flat wick, and consumed 29.8 grammes (459 grains) of oil per hour. The power resulting from the motion of the engine, when applied to the electric machine, produced a stream of electricity or electric light, having an illuminating power equal to that of 234 of the lamps mentioned, showing that three times more light may be produced from a given quantity of oil, if its energy is converted first into mechanical power and then into electricity, than if the oil is directly burned in a lamp.

THE MEETING OF THE NATIONAL ACADEMY OF SCIENCES.

The fall session of the National Academy of Sciences opened in Philadelphia on October 17, under the presidency of Professor Joseph Henry. Professors Joel Allen of Cambridge, George F. Barker and W. H. Gable of Philadelphia, and E. S. Morse of Salem, and General John Newton, were elected members. Professor J. E. Hilgard read an essay on the variations in the standard bars to which all measures are now referred in France, England, and this country. He had compared the iron bars sent to the United States as duplicates of the English bronze bar, and found a variation of 0.00034 inch, which is not an admissible error. Professor Hilgard believes that the bronze and not the iron has changed, and that the alteration is due to one of the metals in the alloy being in a state of tension when the standard was made. In making the platinum standard meter in Paris recently, the metal was remelted and worked over nearly 200 times. The duplicate standards, made of cast steel, for this country, are correct to the $\frac{1}{100,000,000}$ th of an inch, and differ from each other by less than $\frac{1}{100,000,000}$ th of an inch.

Dr. J. L. Leconte read a paper on the hydrocephalus, an insect which resembles a fat mole cricket, and of which there is a specimen in the Brazilian Centennial exhibit. He considered that a careful study of existing insect life will do more to demonstrate its course of development than all that can be accomplished by means of fossils, owing to the fact that insects have kept such forms as they have now, with comparatively slight change, during many ages. The hydrocephalus is especially of service as a missing link between such relations.

The Fire on the Hearth.

The Centennial Commission has awarded a diploma and medal to the stoves exhibited by the Open Stove Ventilating Company, whose invention we illustrated on page 198, volume XXXI. Several are shown in the stove annex of the Main Building, the operation being made visible by the outer jacket being removed from one of them, and the circulation of heat and the delivery of the products of combustion in an almost cold state being clearly demonstrated.

To Dispose of Curculios.

A correspondent of the *Ohio Farmer* writes that he kept a plum tree from curculios by sprinkling the ground under the tree with corn meal. This induced the chickens to scratch and search. The meal was strewn every morning, from the time the trees blossomed until the fruit was large enough to be out of danger. The consequence was that the fowls picked up the curculios with the meal, and the tree, being saved from the presence of the insects, was wonderfully fruitful.

An English inventor proposes to pump exhaust steam back into the boiler in place of condensing it, and experiments are now being conducted with an engine for testing the invention. The inventor contends that "the pressure exerted by the steam on one side of the piston represents, by its elastic power, the same expressions of power in pressure on the other side; so that the elastic charge is always ready to give back the exact power expended for its expression."

A NEW WATER ENGINE.

We illustrate herewith a novel water engine, which may be used as a motor and also, if desired, as a pump. A is the cylinder, which is mounted in bearings of a case, D, on trunnions. It has a circular valve, E, formed on the lower end, with one port, F, and fitted to the correspondingly shaped valve seat, G, in which is the inlet, H, and the exhaust, I, also the exhaust, J, for the waste from the interior of the case, D. K represents passages cored out in the cylinder, from the upper end down to the interior of the waste water case, to conduct any water leaking past the piston, L, into the case, to be discharged through the exhaust. A cap, M, screws on to the top of the cylinder, for a guide to the piston rod, N, and these passages, K, enter the cylinder, above the piston, under this cover. The oscillation of the cylinder in the case alternately opens the supply and exhaust passages.

Patented through the Scientific American Patent Agency, September 5, 1876, by Mr. George Wells, Montreal, Canada.

A Machine for Making Cab Drivers Honest.

The latest invention for securing "machine honesty" is the exceedingly ingenious registering device which is to be placed on the new line of street cabs shortly to be established in New York city. It is the invention of Mr. Louis Von Horen, late of Vienna, Austria, and it serves the dual purpose of preventing the cabman pocketing any share of the fares and also of indicating to the passenger the length of time he occupies the cab, so that there is no room for dispute as to how much the latter should pay. The charge is to be at the uniform rate of 50 cents per hour or the same sum for a single trip occupying less time; and the apparatus is of course adjusted with reference to this tariff.

There is a metal circular case about eight inches in diameter, on the face of which are two graduated circles. The inner circle is pointed off similarly to a clock face, only instead of a twelve hour mark there is a zero. On the outside circle there is a simple graduation of units and tenths, so that dollars and cents by it may be registered. The hands on the inner circle are controlled by clock mechanism in the case; the hand on the outer circle must be moved by the driver. From one side of the clock case extend wire rods which carry a sign on which are the words "to hire;" on the same side, and between the rods, there is an extension in which a watch is placed. The whole is pivoted to the front of the cab, just in rear of the driver's seat, in such a manner that, when the "to hire" sign is turned uppermost, it stands above the cab roof, and is plainly visible. Right in face of the passenger in the cab, there is an opening, empty when the sign is turned up as described, but allowing the watch face to be seen through it when the sign is turned down.

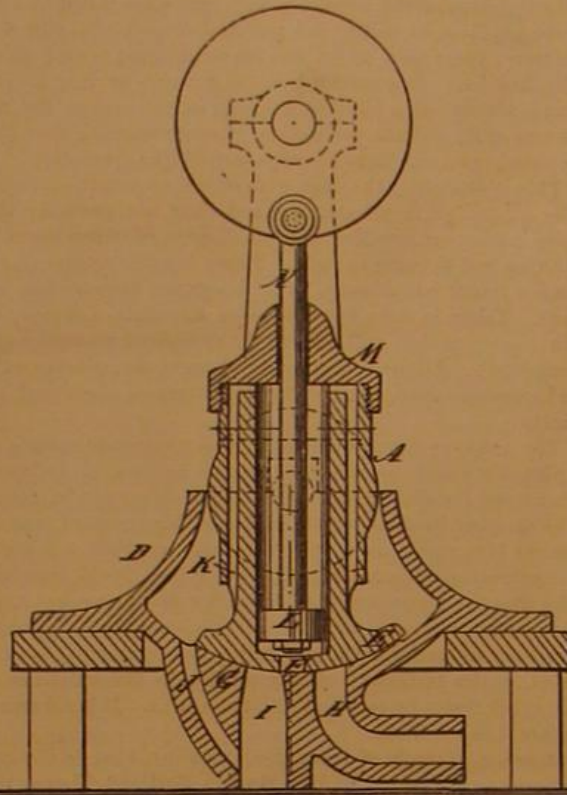
Now, when a cab is hired, the driver is obliged to turn his sign down. If he does not, the passenger will demand it, because otherwise the passenger cannot see the watch which is to be consulted in determining the time he has occupied the cab. The driver, in turning the apparatus, thereby sets the clock going, which, supposing the trip to be the first one made that day, registers hours and minutes from 0 o'clock. When the passenger leaves the vehicle he pays his fare, and this the driver registers after the bell punch fashion on the outer dial already described. The driver then must turn his sign up. If he does not, his clock will continue running, and he will have to account for the time in money. The next passenger is registered in the same way—the clock, however, starting at the point at which it left off before—so that at the end of the day, when the inspector comes around, he sees from the two dials, first, the number of hours the cab has been used, and second, the amount received. On the back of the clock, which, on its face, has these dials, is still another dial visible from within the cab. This is simply an index moved forward one degree each time the sign is turned, so that from this the aggregate number of trips made can be learned. The dial is covered and locked up so that the driver has no access to it; and it obviously prevents the driver from taking advantage of the short trips, less than an hour in duration, but charged for as a full hour. By noting the number of trips and of hours employed, the inspector can determine the exact sum due from the driver, which amount ought to be accurately shown on the face of the register.

The device, while somewhat difficult to describe intelligibly, is really very simple, and as an invention it certainly is the best thing of the kind we have ever seen. It neither incommodes passengers as do turnstiles, nor does it fasten a disagreeable badge on the conductor or driver like the bell punch, nor does it place such implicit reliance on the honesty of the average passenger as is involved in the use of the fare box now in use in all our omnibuses.

How to Settle a Dispute.

The Centennial Judges and Commissioners catch severe scoldings from exhibitors who have received no awards, and from those who do not monopolize all of the praise bestowed on classes of articles. The former think the medals and certificates of no value, on the sour grapes principle; the latter regard them as too cheap and commonly distributed to be worth much. There is only one way to test the soundness of these depreciatory opinions. The Commissioners do not publish the language of the decisions. Perhaps, in justice to the contributors, they ought to do this,

and acquaint the whole world with the official result of the competition. As this is not done by the Commissioners at the expense of the Fair, the winners of the prizes have no option but to do it for themselves. Let the unprejudiced public be the arbiter in these disputes about the practical worth of the awards. The test is easily made. A reasonable amount of advertising in the papers would tell everybody what the judges said of any particular article and where it can be found. People would then hunt it up and see for themselves whether it tallies with the judges' descriptions or not; and at the same time the successful exhibitor would learn from this *experimentum crucis* exactly what the award is worth to him. There is no other possible

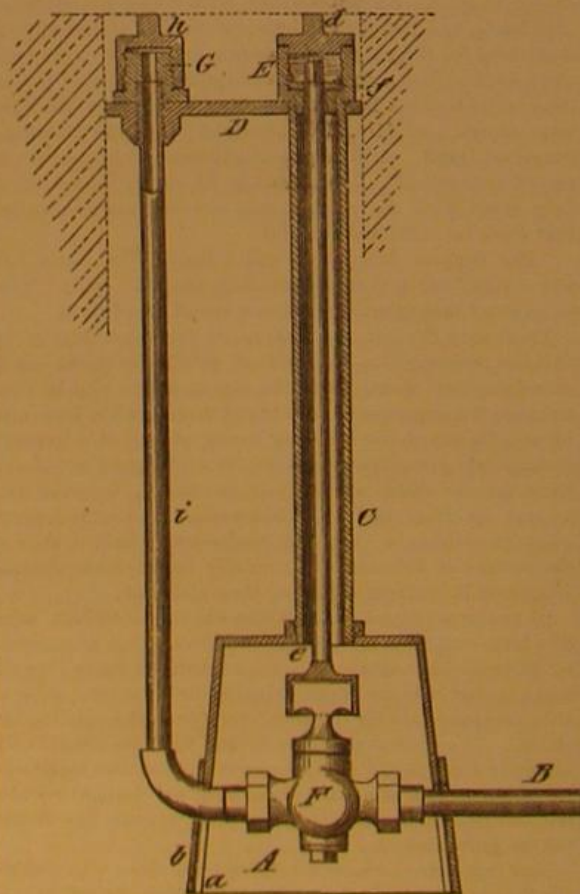


WELLS' WATER ENGINE.

settlement of the controversy, but by advertising. We still adhere to the opinion that the prize system adopted by the Fair managers is the best under all the circumstances; and the recipients of the certificates have it in their power, by judiciously advertising, to turn them into money.—*Journal of Commerce*.

IMPROVED STOPCOCK AND STREET WASHER BOX.

Mr. George B. Hooton, of Williamsburgh, N.Y., has patented through the Scientific American Patent Agency, September 5, 1876, a novel improvement in stopcocks and street washer boxes. It consists of a box, of cast iron, provided with slots, *a*, in opposite sides, to receive the water pipe, B. These slots are closed by the doors, *b*, which are pivoted and



notched to receive the pipe. C is a tube of suitable length, screwed into the center of the top of the box, A, and also screwed into the plate or guard, D. E is a socket formed on the upper surface of the plate, D, and provided with the screw cap, *d*. F is a stopcock in the box, A, the plug of which is provided with an elongated stem, *e*, which runs upward through a hole in the plate, D, and is squared to receive a notched disk, *f*, and the key by which it is turned

The disk, *f*, prevents the stopcock from being turned more than enough to open and close it by engaging with the pin, *g*. The pipe, *i*, for street washing, is provided with a nipple, G, formed on the plate, D, and provided with a cap, *h*, and to which the hose is attached for street washing. When the street washer is not required, the pipe, *i*, nipple, G, and accompanying devices may be dispensed with, and the pipe, B, may run horizontally into the house. When this improvement is used, it is claimed that heaving by frost is obviated. It is impossible for it to become clogged, as there is no channel by which anything can find its way into the lower parts of the device. It is not easily tampered with, as it is impossible to remove the caps without the key or wrench.

How Loggers Live.

Three hundred men will cover and cut a section of about three miles square, taking off over 60,000 logs, which would measure about 10,000,000 feet, each season. Work begins at daylight and ends at dark; and when the days lengthen or the moon favors a longer twilight or earlier morn the men get the benefit in longer working hours. On the river when the drive is started, work begins at three o'clock in the morning and ends at nine in the evening, the men having five meals; breakfast at six, lunch at nine, dinner at twelve, supper at five, and tea at nine. The meals consist of pork and beans, corn bread, molasses cake, and tea or coffee.

No stint is given to a man's appetite. The fare, such as it is, is abundant, monotonous, nutritious, and cheap. A cook is provided for every fifty men. The beans are generally the large white bush, parboiled in pots holding half a bushel, then ten pounds of pork is set in the middle of the beans in the pot, a quarter of a pint of molasses poured in, and then the pot is set in a hole surrounded with hot ashes and burning charcoal, the top covered with a stone, over which a heavy wood fire is built; and here they stay from five to eight hours, coming out a most palatable dish. All the baking is done in rudely built stone ovens, which are heated, before the dough is mixed, with a good wood fire. The loaves of biscuit or cake are set upon the hot stones, and are cooked quickly and thoroughly.

A camp of three hundred men will consume daily four barrels of beans, one half a barrel of pork, one barrel of flour, half a barrel of meal, one quarter of a barrel of sugar, and five gallons of molasses. The men are encamped in tents, making their beds of boughs, while their extra clothing, a pair of duck overalls, woolen shirt, and two pairs of woolen socks, is kept in an old grain sack and used as a pillow at night.

The Sabbath in the woods is always a day for sharpening axes, mending sleds, repairing boots and clothes, setting out a new tenting spot handier to the cutting in the woods, and all the odd chores which would grow out of the congregation of so large a body of men. All well regulated camps exclude liquor. The work being usually fifty to two hundred miles from any settlement, and the men not being paid until the end of the season, there is little inducement for any speculator to peddle rum through the woods, or for the men to straggle off in search of it.

The consumption of axes and handles is enormous, an ax lasting a month, and a handle about three weeks. The axes are sharpened daily, some camps having regular sharpeners, while others require each man to keep his own axe in order. The old axes are never collected for the junk dealer, the distance to ship them being almost too great to make it an economical measure. Woodsmen generally consider spruce harder on axes than either birch or pine. The gum which runs out of the spruce tree is often found hard enough to chip the edge of the axe when striking through it. The styles of axes differ with nationalities, a Canadian chopper preferring a broad square blade with the weight more in the blade than elsewhere, the handles being short and thick. A down-east logger, one from Maine, selects a long, narrow head, the blade in crescent shape, the heaviest part in the top of the head above the eye. New York cutters select a broad, crescent-shaped blade, the whole head rather short, and the weight balanced evenly above and below the eye, that is, where the handle goes through. A western backwoodsman selects a long blade, the corners only rounded off, and the eye holding the weight of the axe. The American chopper, as a rule, selects a long straight handle. The difference in handling is that a down-easter takes hold, with both hands, of the extreme end, and throws his blows easily and gracefully, with a long sweep, over the left shoulder. A Canuck chops from directly over his head, with the right hand well down on the handle to serve in jerking the blade out of the stick. A Westerner catches hold at the end of his handle, the hands about three inches apart, and delivers his blows rather direct from over the left shoulder.

In fact, an expert in the woods can tell the nationality or State a man has been reared in by seeing him hit one blow with an ax. It is, however, an interesting fact to know that a Yankee chopper, with his favorite ax and swinging cut, can, bodily strength being equal, do a fifth more work in the same time than any other cutter, and be far less fatigued. This in a very large degree will account for the greater percentage of Maine men who will be found each year in the woods of northern New England and New York. *Northwestern Lumberman*.

NEW SCREW-CUTTING LATHE.

We extract from the *Moniteur Industriel Belge* the annexed engraving of a screw-cutting lathe, the novel feature in which is the system of friction gearing by which the screw to be cut is made to advance or return. Above a toothed wheel, upon the driving shaft, are placed two pinions, both gearing with the former wheel, and consequently revolving in opposite directions. At the extremity of the pinion shafts are friction pulleys, which bear against the interior of the rim of the large friction disk. By means of a hand lever, either of these friction pulleys may be brought into contact with the disk at will, and the latter thus caused to rotate in either direction, turning the screw accordingly. The device is intended to be portable, and cheap. It is the invention of MM. Weise and Monski, of Halle, Germany.

Red Wash for Brick Residences.

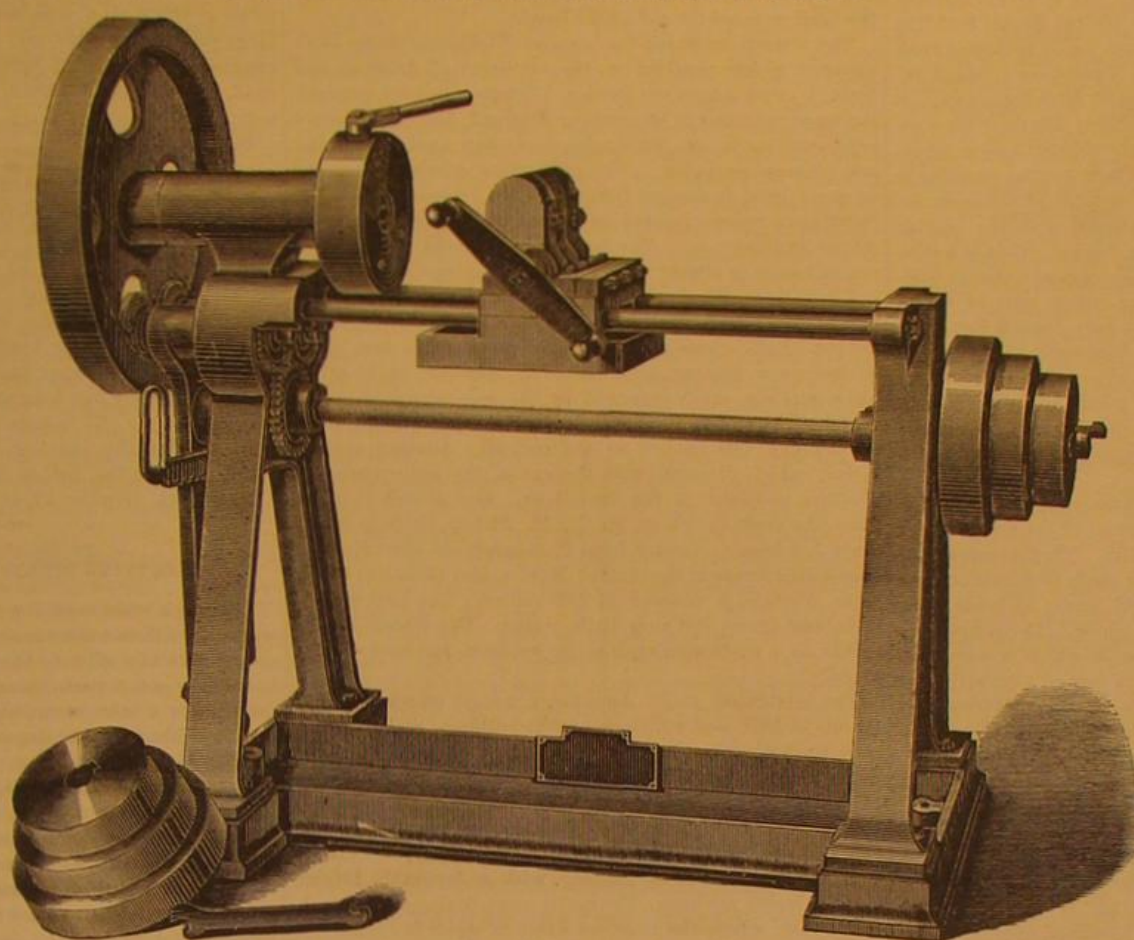
Travelers visiting Chicago are astonished at the beautiful appearance of the brick buildings in that city, showing so distinctly the lines of white mortar between the bricks. It has taken years of trial, says the *Enquirer*, before a mixture could be found that would stand the test of rain and frost. At last the following has given thorough satisfaction: Venetian red and Paris brown, in proportion to suit the taste, are mixed with a quantity of water to make a heavy wash. With this the walls are well coated. To settle the color to the wall, and prevent its washing off by the rain, a wash with diluted muriatic acid (one quarter acid) is given over the painted surface.

The mixture forming the white lines or joints is made of settled white lime, to which is slowly added plaster of Paris, kept stirring until the mixture is past setting; then mix a little fine sand, to keep from cracking, and work into the consistency of glazier's putty. This putty is then applied to the walls by two men, along a straight edge, and with a beading trowel, the distance of the joints having previously been measured. Care should be taken, in applying this putty, to press it strongly against the wall, to prevent any water from creeping between it and the brick. In winter time we should suppose that the water would freeze, expand, and detach the white joint, thus spoiling the look of the building. But it is important if the treatment above described proves effectual. It is certainly worth trying, for an indestructible red and white paint on brickwork is very beautiful.

England's Dilemma.

The rapid stride of Americans in manufactures connected with iron and steel is impressing upon English makers the necessity of accommodating themselves to the demands of the time, to avoid the almost total destruction of the export trade, and to insure the continuation of the home production. Recent publications upon the subject exhibit upon the part of English makers a spirit of earnest inquiry into the cause of their present condition, and a determination to recover if possible the ground already lost. Among the most earnest of these publications are a number of recent editorials in the *London Times*, containing careful reviews of the situation, which is acknowledged to be serious, and the British people are urged not to "resign themselves to a permanent exclusion from the markets in which the United States manufactures compete—and to estimate more justly the conditions on which business should be conducted in future." It is not admitted that the protection afforded by almost prohibitory tariffs has had any material effect in contributing to the success of American makers; but the conclusion is reached that this result is mainly attributable to the reduction of the cost of manufacture in the United States by the use of machinery, mainly devised with the view of dispensing with the hand labor, but incidentally resulting in supplying better products. While English manufacturers have, admittedly, been pursuing old and wasteful methods, encouraged until lately by the low prices of fuel and labor, and have rested secure in the apparent monopoly which has so long existed, the manufacturers of the United States have been forced by the high price of labor to devise and employ appliances for dispensing with or reducing hand labor to as great a degree as possible. It is the success of these efforts that has resulted in almost totally destroying the markets heretofore enjoyed by the English manufacturers in the United States and in greatly impairing their trade in the British colonies, and, in some instances, even in England. As a remedy for this condition of affairs, English manufacturers are placing their workshops upon a better footing than heretofore, by the adoption and use of new labor-saving processes and machinery, and are already congratulating themselves upon the advance made in this direction.

With this view a recent meeting of the Institution of Mechanical Engineers, at Birmingham, devoted a large portion of its time to the consideration of modes and appliances for dispensing with hand labor in puddling, it being admitted that this result was indispensable to the obtaining of products of the quantity and at the prices now required to meet the demands of the market. So, also, earnest efforts are made to remedy the evil by reducing the cost of labor. When our British cousins take hold in earnest with the intention of overcoming obstacles to their progress, we may be



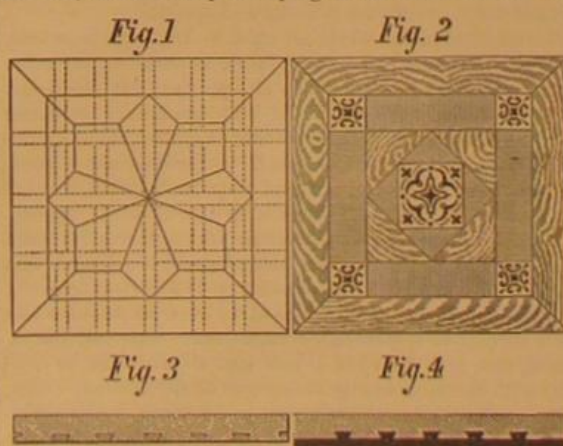
WEISE AND MONSKI'S SCREW-CUTTING LATHE.

sure that such obstacles will be conquered if possible, and American manufacturers may well bear in mind the experience which resulted so disastrously to their rivals, and avoid falling into a like error. There must be no suspension of efforts to perfect and improve, with the idea of having reached a secure point. Those who are in advance must go forward, or they will soon be in the rear.—*American Exchange and Review*.

IMPROVED WOOD CARPETING AND INLAID FLOORS.

The National Wood Manufacturing Company, of 950 Broadway, New York city, for several years engaged in the manufacture of wood carpeting and inlaid floors, have devised a new method of constructing tessellated flooring for private or public buildings, which is illustrated herewith.

Fig. 1 shows a sectional block or square, composed of pieces of wood of various forms, sizes, and colors, combined in one section. By the aid of suitable machinery, a series of dovetailed grooves are cut in the under side of each floor block; and dovetailed strips of wood, or binders of other suitable material, are inserted in these grooves, as shown in the side view, Fig. 3, and held in place by glue or waterproof cement. The blocks are then brought to an even surface and size, and are ready for laying in the usual manner. Fig.



4 shows a modification of this method of construction, a preparation of asphaltum being used, which firmly adheres to the wood, fills the grooves, and forms a solid and substantial backing for each section.

Fig. 2 shows the use of ornamental tiles in combination with the wood, as they are retained in place by the adhesion of the asphaltum. The tessellated flooring is especially adapted to buildings of fireproof construction, and wherever else it is requisite that a strong, durable, perfectly waterproof, and airtight floor should be used. It may be secured to the floor by first spreading a thin layer of hot asphaltum on the floor, and then pressing the sections down upon the floor. The average thickness of the flooring is $\frac{1}{4}$ of an inch for Fig.

3, and $1\frac{1}{4}$ inches for Fig. 4; and the grooves being on the under side, this allows a wearing thickness of about $\frac{1}{2}$ of an inch, or double that of ordinary flooring. The size of the sections average 18 or 24 inches square.

Patented through the Scientific American Patent Agency, May 30, 1876. The patent was reissued on August 29, 1876. The invention was also patented in Great Britain on June 14, 1876, and in Canada on June 30, 1876. For further particulars, address the National Wood Manufacturing Company, as above.

Climbers and Shade.

In houses devoted to the cultivation of decorative plants, grown either for their flowers or the beauty of their leaves, the effect is much improved by the use of climbing plants trained to the rafters in the usual manner; but elegant as these unquestionably are, and much as they contribute to hide the objectionable straight lines of the wood or ironwork, the extent to which they are allowed to cover the roof must be very limited, unless there is a disposition to sacrifice the health and appearance of every plant occupying the body of the house that requires full light in which to grow. No greater mistake can be made than allowing roof climbers an unlimited amount of room in plant houses. Indeed, in the case of amateurs (says a correspondent in the *English Garden*), who may possess only a single house, and who keep this entirely devoted to the growth of flowering plants, with perhaps a few fine leaved ones, the matter should be well considered before any climbers are introduced at all; for even with the most spare growers that can be so employed, those that occupy the body of the house will be injured to some extent. During

the middle of the day, in bright weather, the climbers will possibly do little harm, and to plants in flower they may even be an advantage by breaking the force of the sun's rays; but for every hour they are of benefit to plants underneath them, there occur a dozen in which they do serious injury, and that in proportion to the extent to which they obstruct the light. If amateurs use them in houses of the description under consideration, they should employ only the most spare growers, such as will furnish but a moderate number of pendent shoots, avoiding all strong rampant-growing kinds; for although it is easy to keep the latter within bounds by a free use of the knife, yet this work does not always receive attention, or there is a reluctance to cut away the shoots.

The more light the house affords, from the principle upon which it is constructed, and the favorable position in which it stands, the more roof climbers may be allowed. During bright sunny weather in the summer months, most flowering plants will last longer in bloom if they are shaded in the middle of the day; but nothing is more common than to see this so much overdone that the whole are seriously injured by the obstruction of light through the material employed being too thick, or the use of fixed shading. Where either of these evils exists, it is impossible for the plants to remain long in a satisfactory state. It should always be borne in mind that almost every plant which we cultivate under glass receives in its native country considerably more light than our climate affords; therefore, wherever blinds are used, they should in all cases be attached to rollers, so as to be easily drawn up and down as occasion requires, and they should never be allowed to remain down when the sun does not shine upon the house. Even in the case of ferns (with the exception of the filmy species and a few that exist naturally in shady situations), they thrive much better fully exposed to light when the sun is not upon them.

Training Canaries.

A gentleman residing at Phoenixville, says the *Reading Eagle*, of Queensland, Australia, has several very fine canary birds to which he has given much attention. One of the birds he has taught to sing "Home, Sweet Home," clearly and distinctly. His mode of instruction is as follows: He placed the canary in a room where it could not hear the singing of other birds, and suspended its cage from the ceiling, so that the bird could see its reflection in a mirror. Beneath the glass he placed a musical box that was regulated to play no other tune but "Home, Sweet Home." Hearing no sounds but this, and believing the music proceeded from the bird he saw in the mirror, the young canary soon began to catch the notes, and finally accomplished what its owner had been laboring to attain, that of singing the song perfectly. This is an experiment easily tried, and one we should be glad to know the result of from some of our own bird fanciers if they make the experiment.

Continued from first page.

wherever the visitor may wander, except, perhaps, in the Woman's Building and the Art edifices, boats meet him at every turn. Had this magnificent display been brought together and classified, it would undoubtedly be the largest and most instructive ever gathered. Certainly, any one desiring to prepare an exhaustive work on the subject might find at the Centennial all the material necessary for the task.

The engravings which occupy our first page this week represent a number of the most curious and widely differing vessels, selected from the displays of the different nations. Standing in the middle aisle of the United States Building is the gigantic dug-out—an immense canoe hollowed from the trunks of massive trees—by the Vancouver's Island Indians, and measuring 60 feet in length by 8 feet beam. It is made in four pieces, and was probably intended for warlike purposes. In the engraving, the painted bow is represented, covered with the strange picture writing peculiar to its savage builders. The designs, notably of the eyes, depicted near the bow, curiously correspond with the similar decorations to be found on Chinese junks. This is a slender link, but is perhaps of some ethnological value in indicating the relationship between the tribes, part of which went to the southward in Asia, and part crossed Behring's Straits, and entered the American Continent. The British Columbian whaling canoe, shown above the dug-out, reminds one somewhat of a Venetian gondola. It is made in few pieces, and has a broad gunwale ending in a fork at the bow. The same strange Indian designs are painted both inside and outside the vessel.

Not very long ago, the yacht *Amaryllis*, built on the catamaran principle, vanquished several of the finest center board and keel yachts in this vicinity. This circumstance has directed interest to this peculiar mode of construction; and we represent three of these odd boats, as made in as many widely separated parts of the globe. The simplest is the catamaran of the Philippine Islands, which is merely an ordinary canoe having two bent spars lashed athwart ships and connected by rough cross logs at their extremities. These prevent the boat capsizing, through resisting her tendency, when she heels, to submerge them. The anchor used by the Philippine Islanders is likewise represented. It consists of an iron-tipped hook of wood, and is obviously of little value, since there is no way for it to hold bottom unless the hook end falls underneath.

The second catamaran, that peculiar to Pernambuco, Brazil, is of an entirely different species, and is not a true type of its kind. The name catamaran is, however, applied in the navy to an assemblage of empty casks, lashed together and covered with a staging to form a raft; and in some parts of the world any raft of logs obtains a similar title. The present craft is, however, peculiar, because it has a center board, an odd appliance for a raft. The cabin, which is just big enough for the occupant to crawl into head first, is mounted on a slanting platform, and there is a huge steering oar held in a high crotch. The sail is odd shaped, and, being widest at the top, is excellently adapted to capsize any vessel on which it may be placed; hence probably the reason for the center board. Catamaran No. 3, from the Sandwich Islands, is an elaborate affair, but genuine in its way, inasmuch as it embodies the principle of "united we stand, divided we fall," as all true catamarans should. The main canoe is so very high and narrow that it would promptly upset, even without the aid of its immense mast and sail; but the broad outrigger and solid boat-shaped block at the end thereof hold up the whole fabric. These vessels sail faster than any known sailing craft, and are staunch in the roughest seas. The Hawaiian catamaran is a double-ender, that is, it sails either bow or stern first. It never tacks to turn around. When the ingenious captain desires to go about, he casts loose the forward lower corner of his sail, hauls it around to the other end of the boat, and makes it fast there. Notice, also, that the mast is stepped on the gunwale and thus brought nearer to the center of gravity of the whole combination.

Another curiously primitive boat is the tub-like affair made by the Gros Ventre Indians, of Dakota Territory. It is a mere basket of ash or hickory withs, covered with raw hide, and propelled by the paddle shown. An odd fact here to be noted is that this craft is almost identically the same as the coracle used on the rivers in Wales for fishing purposes. In fact no one can study all these kinds of boats without becoming impressed with the similarity of working in the minds of people, utterly dissimilar in race and in every other respect, in order to reach a given object. Compare the old Swedish anchor, illustrated side by side with the like device peculiar to the Brazilian aborigines. The same apparatus is employed by our own east coast fishermen. Doubtless hundreds of persons have each deemed themselves the original and only inventor of that contrivance.

There are strange contrasts among the boats. The Philippine catamaran is so long and narrow and high that it must, to sail at all, be held up; on the other hand the Dutch fishing pink is so short and broad and low that it would be difficult to upset it. The craft is very nearly as broad as it is long; the mast is stepped very nearly in the middle of the boat, and there are two bowsprits, although why the ordinary rule, of attaching jib and staysail to one spar, is not followed is a mystery. The pink is built for sailing in very shallow water, such as is found on the shoals in the North Sea; and to prevent her drifting to leeward, crab-fashion, huge weather boards are attached to her sides and dropped vertically into the water to offer a wide area of resistance. These vessels, like everything Dutch, are usually models of neatness, and abound in varnished wood and brilliant brass ornaments, to the exclusion of paint.

Another sharp contrast is found between the Indian skin boat, already described, and the Greenland kayak or "man's canoe." This boat is usually about 16 feet long, 2 feet broad, and 1 foot deep. The bottom is rounded and has no keel. The frame is kept stretched above by a large number of little beams, and two strong battens run from stem to stern, which, toward the middle, are attached to a hoop of bone large enough to admit the body. The frame is entirely covered, with the exception of the circular hole in the center, with freshly dressed seal skin. When complete, the boat weighs about 60 lbs., and is so constructed that it can be carried on the head without the aid of the hands.

The vessels in which the ancient Northmen made their voyages, which resulted in the discovery of America and Iceland, or in which the Danish Vikings sailed on their pillaging expeditions to the coast of England, find their modern reproductions in the Norwegian craft now used for fishing and pleasure purposes. The high prow, whereon was the dragon's head in ancient times, may be traced in both the Nordland's raasels (reefed sail) yacht and the fishing smack which we illustrate. The former has the old square sail, and in model is almost the same as the Vikings' vessels.

The curious Russian double canoe is in the Russian section of Machinery Hall. It is a beautifully made craft, having a hull in two portions and a comfortable arm chair located on a grating between. The Russian single canoe has a neat rig, easily managed by the sole occupant of the vessel. The gaff is fitted with halliards and downhaul, leading through fair leaders to the cockpit. Another type of vessel, which disputes with the canoe the supremacy for pleasure purposes, is the duck boat. Our sketch is taken from the craft in which Mr. N. H. Bishop, of New York, made his famous voyage from Pittsburgh *via* the Ohio and Mississippi rivers to the Gulf of Mexico, and thence to Cedar Keys, Florida, a distance of 2,600 miles. The boat is very wide, and draws but very little water. The screen shown serves as a protection against the weather, and as a tent at night.

The celebrated yacht *America*, a vessel which won her laurels in 1851, and which our yacht builders, with all their skill, have never yet improved upon, had masts which raked heavily aft, and she drew nearly three times as much water aft as forward. Despite the speed and other advantages thus gained, a shipbuilder in Bombay has constructed the *Ocean Queen* in diametrically the opposite way, and claims that she beats steamers, making, with a favorable breeze, some 20 knots per hour. The masts rake, Malay style, greatly forward, where the heaviest draft of water is found. It remains for naval architects to reconcile the discrepancy if they can.

The last two vessels which we have to describe are essentially the outcome of Yankee ingenuity. The first is a non-heeling boat. The hull is hung on pivots in a heavy frame, which constitutes stern post, stem post, and keel in one. The mast is stepped in the stern. Consequently, when the wind pushes the sail horizontally, the keel, etc., are alone lifted, while the boat remains perpendicular. The turkey bone yacht, some ingenious New Englander has contrived from the sternum of the turkey. It is needless to say that its size is diminutive, and that it is not intended to sail. A deck is attached to the under part of the bone, the narrow projecting part of which forms the keel. Rudder, bowsprit, mast, and sails, and small boats complete the resemblance to a miniature sloop.

Correspondence.

The Necessity of an Effective Steam Engine Governor.
To the Editor of the Scientific American:

The most important question for our manufacturing interest is how to reduce cost of production without cutting down wages of operatives, now too low in many sections of the country. As manufacturers look to you largely for information and help, permit me to make a suggestion.

The markets of the world are open to American manufacture, provided they can furnish fabric as cheap as any other nation. We can produce goods cheaper, and yet pay a fair price for labor. We have the best machinery, and our operatives are more intelligent and capable than can be found elsewhere. How then shall we produce more goods from the same mills and without material increase of cost? The answer is simple: By increasing the speed of machinery, which cannot produce its most profitable results without being run at the highest rate of speed consistent with its durability and with the production of a perfect fabric.

But no machinery can be run at or near its highest rate when subject to uncontrolled variations. Suppose, for instance, that it is found in a mill that all work can be well done with the main engine running at 55 revolutions. Now, if the engine varies 4 revolutions in its speed, under different loads of work or a varying pressure of steam, it is manifest that it will not be prudent to run the engine at over 52 revolutions, lest mischief be done when the speed increases. If the engine could be held within one revolution, it is clear that it could be run at 55, and practically, with its steady motion, even a little higher than that. This would give a net increase in production of from six to ten per cent. Until recently, this has not been practicable, but it has become so.

Mr. Huntoon, of Massachusetts, a most thorough engineer, who has devoted twenty years of his life to controlling steam engines, has invented a governor which will do this, and which is rapidly coming into use. His governors are now used by the Merrimack Manufacturing Company, the Naumkeag, the Groveland, and hundreds of other mills, and are

in many cases largely increasing their production. This governor is simple in construction, not liable to get out of repair, neat in appearance, noiseless, powerful, and inexpensive.

The unnecessary wear and breakage of machinery and consequent stoppage for repairs, the temporary delays for mending broken threads, and the value of various fabrics injured or spoiled, are all large items in the expense of running a mill, a great part of which is the result of varying speed. The increase in quantity and improved quality of the products of cotton, woolen, iron, flour, and all other mills running at a maximum and even speed, will give a large profit over what can be produced by the same mills running with varying speed. It will give me pleasure to send, to persons interested, full descriptions of this governor.

STILLMAN B. ALLEN.

Boston, Mass.

Large Belts.

To the Editor of the Scientific American:

In your issue of October 7, mention is made of a very large rubber belt, manufactured by the New York Belting and Packing Company, namely, 331 feet long and 4 feet wide, which was considered the largest belt ever made. Messrs. J. B. Hoyt & Co., New York city, have recently made, for Jessup & Moore's paper mill at Wilmington, Del., a double leather belt 186½ feet long and 5 feet wide. It weighs 2,212 lbs., contains 1,865 square feet of single belting, and has taken 150 of the heaviest oak-tanned hides, selected from 5,000. I think this belt is the largest ever made.

New York, October 14, 1876.

S. R. K.

[For the Scientific American.]

CUTTING SPEEDS FOR LATHE WORK.

There is a wide variation in the speed at which different workmen will cut the various metals in the lathe, and it is very difficult for all save the most expert to determine when a tool is or is not performing a maximum of duty. We append below a table of cutting speeds for average work upon metals of the ordinary degree of hardness. Here, however, we may remark that these rates are not intended for use with tools which are so slight in form as to require to be tempered below a very light straw color; and the figures have in fact been determined from the use of tools whose temper has not been drawn at all, for the reason that no turning tool should have its temper drawn unless it is so thin as to be liable to bend from the cut, as in the case of a very slight parting tool. If it should be found in any case that the tool will not stand the rate of cut here given, the fault is most likely in the tool, and should be looked for in the forging or the shape thereof. The fault in forging is apt to be overheating in the fire. If, however, the metal of the work becomes, when the tool is applied to it, bright and glossy-looking, it is hard, especially if the turnings fly off in spurts. If, upon brass work, the tool at the given speed springs into the work, or either jars or chatters, the fault lies in the shape of the tool, and not in the cutting speed; and the remedy to be applied is not to grind the uppermost face of the tool so keenly, which will inevitably remedy the evil. The lathe revolutions are given, instead of the feet of cut per minute, so that the operator can ascertain the ratio of the duty he is performing without requiring to make a calculation. For copper work, the speed may be from two and a half to three times the speed given for brass work.

If hand tools are used, the speed may be in each case increased, especially in the case of scrapers upon cast iron and brass.

WROUGHT IRON WORK.

Diameter of work in inches	Lathe revolutions per minute for roughing cuts	Lathe revolutions per minute for finishing cuts
1	135	145
2	50	60
3	30	35
4	20	23
5	16	18
6	12	14

CAST IRON WORK.

Diameter of work in inches	Lathe revolutions per minute for roughing cuts	Lathe revolutions per minute for finishing cuts
1	145	150
2	70	85
3	45	55
4	30	38
5	23	30
6	16	22

BRASS WORK.

Diameter of work in inches	Lathe revolutions per minute for roughing cuts	Lathe revolutions per minute for finishing cuts
1	450	450
2	194	200
3	100	110
4	66	72
5	45	70
6	37	70

STEEL WORK.

Diameter of work in inches	Lathe revolutions per minute for roughing cuts	Lathe revolutions per minute for finishing cuts
1	75	80
2	35	45
3	30	30
4	15	18
5	12	15
6	9	10

New York city.

J R

Raising Nut Trees.

Every true lover of nuts likes to raise trees and test the different varieties. The very best kinds should be selected for cultivation, says a writer in the *American Socialist*; and if the seeds are saved from the most perfect of them, the chances for producing good fruit will be more certain. The best method of keeping nuts for seed is to let them get quite ripe before gathering; then partly dry them and mix in dry sand, put them in thick, mouse-proof boxes, and bury in sand on a dry bank. In spring, select a rich, loamy soil, plow deep, pulverize well, and drill in the nuts, far enough apart to allow the trees some space to grow and room to cultivate between the rows. As soon as the young plants appear, the soil should be loosened around them frequently, which will effectually prevent weeds from growing, as well as hasten the growth of the plants.

After the second year's growth it might be well to clip off the ends of the vigorous side branches, thus sending the life into the main stem. As the stalk grows stouter, the branches may be cut close. However, it is better to leave them on a little too long, than to have slender, top-heavy trees.

Do not transplant until they are large enough to be staked, or until they are three or four years old. The ground, if intended for an orchard, should be subsoiled, and the holes for the young trees dug deep, and fertilized with a little old manure, unless the soil is very rich. The trees may be carefully dug, saving all the roots, and leaving them as long as possible and free from bruises. If a part of the soil can be removed with them, all the better. The roots that chance to get cut by the spade, should be cut clean from the under side, in order that the rootlets may start in the best direction. They must be covered with earth or cloths until they are set out.

In setting, some advise to lean the tree a little to the west, or in the direction of the prevailing winds. The young trees may be set at the same depth as when taken up. The roots should be carefully spread, and fine soil packed tightly around them with the hand, and then filled in with dirt and trodden down firmly. A good stout stake, with a string and cloth fastened tightly around it, finishes the job, and the storms may come. Stir the ground often till dry weather, then spread a thin layer of manure, or a thick coating of chip dirt, old straw, or other litter. These are of great benefit the first year, saving the labor of stirring the soil.

After the first year's growth, in order to make handsome and fruitful trees, it is necessary to use the knife freely. "I prefer training the main shoot as leader, encouraging the branches that start out at nearly right angles, and checking or cutting away those too much inclined upward, as they are apt to split off when laden with fruit or snow. I would cut away all branches not radiating from the center of the tree, as well as all cross branches, leaving them far enough apart to let in light and sunshine, and keeping the tree symmetrical in every direction. This can be done by clipping back those branches which have a tendency to get ahead of the rest; and an abundant crop of nuts may be expected."

Professor Wanklyn's Method of Treating Permanently Hard Waters.

These waters contain the sulphates of lime and magnesia, which have always proved to be the most difficult of removal. Professor Wanklyn has recently proposed to soften waters of this class by first adding bicarbonate of soda and then lime. The bicarbonate of soda first converts the sulphate of lime into bicarbonate of lime, and subsequent addition of lime precipitates the bicarbonate so formed. Sulphate of soda remains in solution in the water.

If hard water must of necessity be employed for scouring with soap, it is advisable to separate the hardening matter, by mixing a sufficient quantity of a hot solution of soap with it, and then causing it to run through a filter bed before use. The insoluble soaps will thus be separated without attaching themselves to the wool or fabric, and they may be collected and treated with hydrochloric acid, to decompose them and separate the fatty acids, which may then be collected and reconverted into soap, by boiling them up with caustic or even carbonate of soda, and the soap thus obtained may be used again, for the same purpose. Water thus treated is well adapted for the scouring of wool and woolen goods.

Organic matter, oxide of iron, and often a considerable proportion of the hardening matter, may be caused to rise to the top, and may then be skimmed off, by dissolving alum in the water in the proportion of about 4 ozs. per 1,000 gallons, and then rising it to near its boiling point.

In preparing waters which contain alkaline or earthy carbonates or bicarbonates, as a bath for either mordanting or dyeing, they should be treated with sufficient sulphuric acid to expel all the carbonate acid, and neutralize any alkali which may have escaped washing out from the scour. The use of bran is frequently serviceable in removing impurities from water in the bath.

The refuse waters from a woolen manufactory contains within themselves the elements of their own purification. At the present time, the practice is to turn these refuse waters into the river courses as they are done with. Sometimes mordant baths are run out; at other times the spent dye baths, and soap, or alkaline fluids. These mingle in the common receptacle, the river, and precipitate each other there, thus producing those black deposits which give to our streams in the woolen districts such an inky and foul appearance. Solutions of all the substances used in our woolen industries have mixed and it is found that they precipitate one another, and leave the supernatant water in a tolerably clear condition. The remedy seems to be, so far as the woolen trade affects the purity of the rivers, to run

all the liquids into one common reservoir, and, after subsidence, to pass, if necessary, the supernatant water through a filter bed into the river. The utilization of the black muddy deposit would, doubtless, speedily follow.

On the Size and Weight of Atoms and Molecules.

When a compound body has been divided and subdivided until it is no longer possible to divide it again without splitting it up into its constituent parts, this extremely small particle of matter is called a molecule. A molecule is defined to be the smallest particle of matter that can exist alone by itself. Physicists have also learned that all molecules are of the same size. This law, as laid down by Avogadro in 1811, and by Ampère in 1814, is that "equal volumes of all substances, when in the state of gas, and under like conditions, contain the same number of molecules." These molecules are each made up of one or more atoms, an atom being the smallest particle of matter that can exist in a compound. The molecules of most elementary bodies are made up of two atoms, a few of four atoms, and a few of one atom. As all molecules are of equal size, it is easy to determine their relative weight, provided only that we can convert the substance into a vapor; for its vapor density, or specific gravity as gas, referred to that of hydrogen as unit, gives us the weight of the atom in terms of the hydrogen unit. Thus it happened that we have long known the relative weight of the atoms of nearly all simple bodies, and the weight of the molecules of many compound substances.

To determine the actual absolute size or weight of an atom or of a molecule was, not long since, considered impossible, but careful physicists have succeeded, using as their foot rule the length of a wave of light, in measuring with an approach to accuracy the size of these infinitesimal objects. Sir William Thomson fixes their size between the $\frac{1}{1000000000}$ and the $\frac{1}{10000000000}$ of an inch, probably the $\frac{1}{1000000000}$ of an inch, or the $\frac{1}{10000000000}$ of a millimeter in diameter; and the weight of a molecule of hydrogen, he places at the fifteen million, million, million, millionth of a milligramme (or 0.0000000000000000000015 milligramme), and the weight of an atom of hydrogen is just half that.

J. Annahaim published a paper in the last number of the proceedings of the German Chemical Society of Berlin, in which he described an experiment for showing the minute sizes of molecules and atoms; but his results permit us to suppose the atom of hydrogen far heavier, and therefore larger, than Sir William Thomson's calculations indicate.

Annahaim's experiment is an interesting one nevertheless, because it appeals to the eye, and as a lecture experiment must prove a striking illustration of the extreme divisibility of matter, without the necessity of the rather tedious course of reasoning and abstruse calculations of Thomson. Annahaim dissolves 0.0007 gramme (= 0.0108 grain) of fuchsin ($C_{20}H_{15}N_3Cl$) in alcohol, and dilutes the solution to 61 cubic inches. In every 0.061 cubic inch there is 0.000010801 grain of the dye. If some of this liquid be placed in a burette of 1 centimeter (0.39371 inch) in diameter, it will appear strongly colored if viewed against a white background. If we drop the thirty-fifth part of a cubic centimeter into a small dry test tube, 0.8 centimeter ($\frac{1}{8}$ inch) in diameter, the red color can be recognized with certainty by placing the test tube inclined upon white paper, and observing it parallel with the surface of the paper, a second tube of pure water being placed beside it for comparison. This shows that the naked eye can perceive the 0.00000002 gramme of fuchsin (or 0.0000003 grain). As every drop must contain at least one molecule of the substance (whose molecular weight is 337.5) the absolute weight of an atom of hydrogen is not over 0.0000000005 gramme. Cyanin gives about the same figures for a hydrogen atom.

Proposed Retention of the Main Centennial Building.

It now seems probable that the Main Building at the Centennial Exposition will not be torn down after November 10, but will be allowed to remain for permanent exhibition purposes. A request of this kind from prominent citizens of Philadelphia was recently made to the Fairmount Park Commission, but was refused. A conference committee has, however, since been allowed, and the matter has been so forcibly urged that the Commission, it is believed, will reconsider its determination. The building is excellently suited for the purpose intended, much better so indeed than Machinery Hall, which was at first proposed. It is strong, and will stand for twenty years if provided with a tin roof and otherwise cared for. Several of the foreign governments have expressed their willingness to allow their exhibits to remain, and some foreign exhibitors will even increase their displays. About six hundred thousand dollars are required for the enterprise, half of which, we learn, is already subscribed, and the remainder is easily obtainable. The idea is an excellent one, as a great permanent show in which new devices of all kinds can be expeditiously introduced to the public has long been needed. We trust the plan may meet with every success.

Iron Rust as a Cause of Fire.

The rather old notion that fires may be caused by iron rust is thus defended by a recent English writer: "When oxide of iron is placed in contact with timber excluded from the atmosphere, and aided by a slightly increased temperature, the oxide parts with its oxygen, and is converted into very finely divided particles of metallic iron having such an affinity for oxygen that, when afterwards exposed to the action of the atmosphere from any cause, oxygen is absorbed so rapidly that these particles become suddenly red hot, and, if in sufficient quantity, will produce a temperature far be-

yond the ignition point of dry timber. Wherever iron pipes are employed for the circulation of any heated medium (whether hot water, hot air, or steam), and wherever these pipes are allowed to become rusty, and are also in close contact with timber, it is only necessary to suppose that under these circumstances the finely divided particles of metallic iron become exposed to the action of the atmosphere (and this may occur from the mere expansion or contraction of the pipes) in order to account for many of the fires which periodically take place at the commencement of the winter season."

Artesian Wells as a Source of Power.

The *Chicago Journal of Commerce*, in an article on the utilization of the water pressure developed by artesian wells, for the driving of engines etc., makes the following statements, and invites criticism thereon: 1. It is affirmed that many of the wells bored in Chicago or vicinity are capable of throwing a jet of water to a minimum height of 30 feet. 2. "A column of water, 1 inch in diameter and 20 feet in height, held in a strong tube screwed into the head of a full cask, will so expand its contents that it is next to impossible to construct one of sufficient strength to withstand the pressure. Such a pressure as this would drive a turbine wheel with all the power and velocity necessary to keep in operation four run of millstones." 3. Consequently an artesian well, capable of lifting a four-inch column of water 30 feet high, and pouring it into "a large receiving reservoir 15 or 20 feet above a turbine wheel, would supply water power sufficient for a very large manufactory."

Admitting our contemporary's assertion that water is projected to the height of 30 feet, and taking in connection therewith the largest yield per day, ascribed by good authority to the best Chicago well as 420,000 gallons, it is easy to calculate the horse power gained. It would be about 72,000 foot pounds per minute, which corresponds to about $2\frac{1}{2}$ horse power; or if the turbine is adjusted with 20 feet head, as suggested, there would be actually utilized about 80 per cent of $1\frac{1}{2}$ horse power, which would scarcely drive any very large manufactory. There are, we believe, about 40 wells in Chicago, with an average flow of 200 gallons per minute. Supposing, for the sake of the calculation, that all ejected their water to a height of 30 feet, the aggregate power would be 58 horse power. The depth varies from 650 to 1,646 feet, or averages 1,148 feet per well, or a total of 45,920 feet for all. Now, says the *Journal*, "the expense of boring and tubing would be about \$1,000 for each 100 feet." That is \$10 a foot or the sum of \$459,200 for making 40 wells just like those now in existence, by which just 58 more horse power would be gained, at a cost of nearly \$8,000 per horse power!

Our contemporary has been confounding pressure with power, as the second of its assertions above given plainly shows. Nearly 500,000 gallons of water a day thrown 30 feet into the air by a mere natural spring sounds gigantic, but a very small steam pump would accomplish the same with ease. It would take about five times as many wells as Chicago now has to produce as much water daily as the great pumping engines at her waterworks now raise, and about twenty-two times as many such wells as are above noted to aggregate the power of the same vast machines.

Shipping Nitro-Glycerin.

Professor Mowbray, of North Adams, started for Omaha, last week, to get permission to ship 10 tons of nitroglycerin over the Union Pacific road to Virginia City for use in the Sutro tunnel. All the other roads allow its transportation now, even the New York Central, which will not take baled hay, for fear of fire. The nitroglycerin is carried in refrigerator cars; and as it congeals at 40°, it is easily kept frozen, and in that state it cannot be exploded. It takes about ten days to ship it to the tunnel; and if it can be taken by rail, Mr. Mowbray can have a contract for 25,000 lbs. a month for a number of years. The Professor has his new factory so systematized that but two men are kept in the works, and they can make all the nitroglycerin he can sell. He uses only a tun of coal a week now, whereas he used to burn a tun a day. He buys his coal in New York, and puts it down at his works on the mountain at a total cost of \$6 a tun.

The Cat's Eye.

For scarf pins and finger rings, the cat's eye has become one of the most fashionable stones used. It is a species of the sapphire, and the most desirable color is of a yellow-green tint. It has threads of white asbestos within it, and the light is reflected from these in an intense and peculiar manner. When this stone is properly cut, a white band of light is seen floating in its interior, that changes position as the gem is moved before the eye, which peculiarity probably suggested the name by which it is generally known.

The First Brooklyn Bridge Cable Passed.

The work of carrying across the first immense wire cradle cable, of the East River bridge, was recently successfully accomplished. The great rope was attached by sister hooks to wheels which rested on the carrier cable, and the movement of the latter slowly transported it over the river. The work of connecting the cable to the anchorage is now in progress, and will occupy considerable time.

A CORRESPONDENT sends us from Franklin, N. Y., a twig from an apple tree which has at its extremity a perfectly formed and colored apple, which is a little less than a quarter of an inch in diameter, strongly fragrant. It appears to be of the Baldwin variety.

COMBINATION CHAIR AND SECRETARY.

We illustrate herewith an ingeniously constructed piece of furniture, which combines the conveniences of an arm-chair, secretary, writing table, drawers, etc., with those of a work table, scrap bag, needle and thread repository, and other appliances of the sewing room. The whole is portable, occupies but little space, and may be moved as easily as any simple household article of corresponding size.

The arm-chair, together with the case or secretary, is supported on a rectangular base frame, A. The legs of the chair rest directly upon the floor so as to ensure steadiness. Casters are provided on the legs beneath the table, so that, by lifting the chair end, the whole piece of furniture may be easily rolled about, even when the secretary is loaded with books, as the weight comes immediately above the casters. Drawers are placed, as shown, beneath the seat of the chair, and open sidewise. The inside of the secretary is arranged with movable pigeon holes for papers etc., which can be taken out, so that this space can be used as a lady's work receptacle.

The front drawer, B, serves, when open, as a support for a front folding leaf. The side drawer, C, holds pen and ink. An extension, D, on top of the secretary, is attached to the back of the arm-chair to strengthen the same, and is bracketed to support the rear folding leaf of the table. An extension bellows-shaped portfolio, E, is placed in rear of the case, and may be used as a newspaper receptacle or scrap bag. The arrangement of the folding leaves of table, D, is optional, as they may be hinged at the front, back, or end edge of the top, and may be used for various purposes, as may be desired. The door of the case is made double, and divided by horizontal strips, F, into secret compartments for money or valuable papers, and is closed by a tightly fitting piece which locks into the side of the door.

The device may be appropriately finished and decorated so as to constitute an attractive and ornamental piece of furniture. Patented through the Scientific American Patent Agency, September 2, 1873. For further particulars relative to sale of patent or royalties, address the inventor, Mr. George C. Taylor, Thibodeaux, La Fourche Parish, La.

A Mouse Plague.

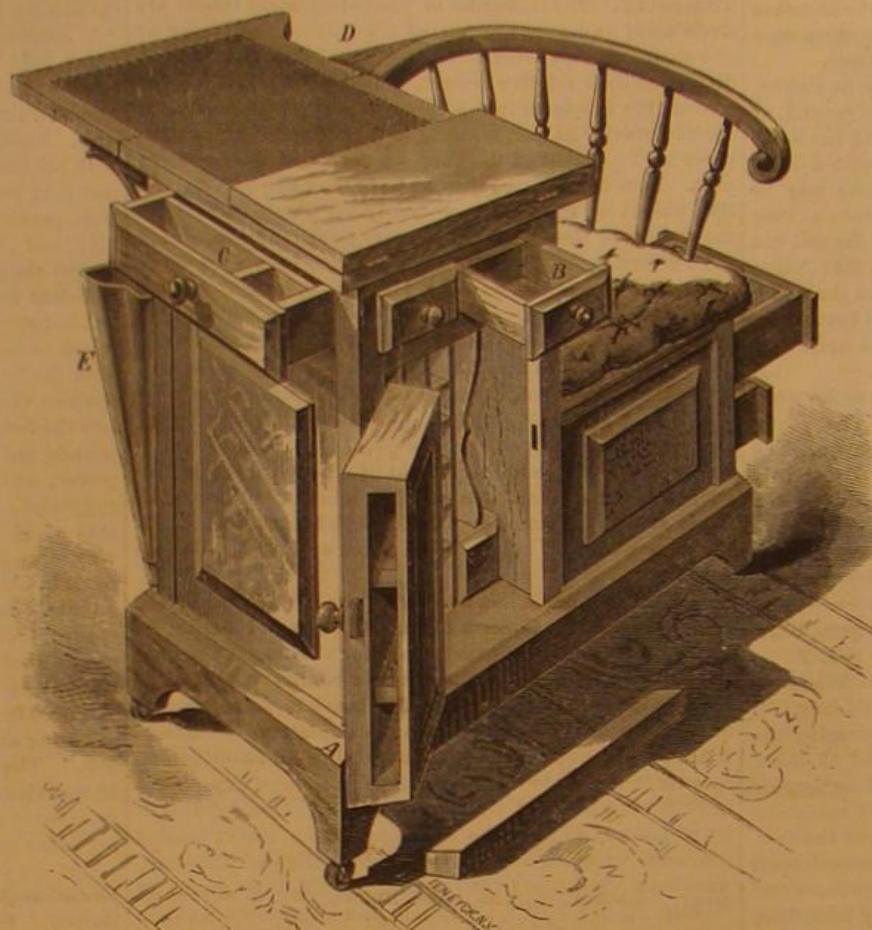
The Scotch farmers appear to be at their wits' ends for means of ridding themselves of the vast armies of mice which are threatening to overrun the border country. The land is represented as resembling the ground in the neighborhood of targets for rifle practice, being literally riddled with holes. All the vegetation is destroyed in certain localities in Teviotdale, not merely the blades of grass, but the roots also, having been consumed. The farmers are encouraging the increase of hawks, owls, weasels, and other carnivorous birds and beasts.

R. HOE & CO.'S IMPROVED INSERTED SAW TEETH.

Since the introduction of inserted teeth for circular saws, their employment has steadily increased, and promises still to do so. In a plain or solid circular saw, the destruction of one or two teeth necessitates the filing down of all the others to the size and radius of the broken ones, and a continuous reduction in diameter accompanies the wear of the saw. It is necessary, in order to maintain the circumferential speed of the saw, to alter the sizes of the driving pulleys, which in turn involves a change in the length of the driving belt; and it is to these defects and inconveniences that the success of inserted teeth is mainly due. In the forms at first adopted for inserted teeth, the sockets in the saw blade are found to become gradually enlarged from the pressure, notwithstanding the spring of the blade, which for some time takes up the wear, and the teeth consequently get loose. Another and very serious objection to the ordinary form of inserted teeth, as compared with the new system illustrated in our engraving, lies in the fact that when, from the breakage of a few teeth, it is necessary to reduce the remainder, to make the saw run true and all the teeth perform cutting duty, the clearance of the teeth becomes so greatly reduced that it is necessary in some way to restore it. To accomplish this result, special swages were invented; but the action of these swages is to spread the front of the teeth by upsetting the metal at the cutting edge; and a fatal objection to this is that, as every machinist knows, by this disturbance of the grain of the steel, its strength is greatly reduced and its cutting qualities impaired. The practical result of course is that the corners of the teeth break off when in use, especially upon coming in contact with knots. If new teeth are inserted, instead of the damaged ones, the process becomes expensive; and the new

teeth still require filing down to run true with the remainder, so that the swaging process, with all its imperfections, is generally applied.

In the present form of the inserted teeth, which is an improvement of the form shown on page 322, volume XXXII, the cost of insertion is reduced to a minimum, because the most expensive part, that is the socket, is not subject, except in exceptional cases, to wear or breakage; and the form of the cutting point or chisel bit is so simple that its cost is trifling. As a consequence, in case of breakage it is simply necessary to insert new bits, and not to file down and swage the whole of the teeth to accommodate the defects of a few



TAYLOR'S COMBINATION CHAIR AND SECRETARY.

damaged ones: thus not only is time saved, but the life of of the teeth is greatly prolonged. In our engraving, one tooth is shown in the process of being inserted, and another in its proper position; and it will be observed that they are firmly locked in the saw without the use of either rivets or keys. The wrench used for this purpose has two projecting pins, which fit into corresponding holes in the shank as shown in our engraving, and the operation is easily effected by any one. The chisel bits are forged at one blow under a drop hammer, and every part of tooth shank and chisel bit, is made to a standard gage, so as to be entirely interchangeable. The grinding of the cutting edges is done by adjustable machinery, so that uniformity is secured in the keenness of rake, as well as in the width and clearance. The cutting



R. HOE & CO.'S IMPROVED INSERTED SAW TEETH.

bits, being short, are exceedingly stiff, and they are tempered as hard as a carpenter's chisel. They may be ground three times, which makes four runs for the teeth, before being worn out; and each tooth in the saw will, it is claimed, cut from one to two thousand feet of lumber, depending upon the quality of the logs and the amount of feed carried.

The saws are made from 13 to 6 gage in the thickness, and from 12 to 72 inches in diameter, the smaller sizes being admirably adapted for edging and gang saws. For further particulars, address R. Hoe & Co., 504 Grand street, New York city.

New Improvements in Aerated Bread Making.

Aerated bread derives its name from the fact that its manufacture is carried on by a process in part the same as that employed for making aerated water. In the case of aerated bread we have a mechanical process, and in the case of fermented bread a chemical process; so that perhaps machine bread would be a better name for the former product than the title now given to it. Some improvements in the manufacture have lately been introduced in England, which we are informed are of a very important character, since they admit of the production of whole meal or brown aerated bread. The improvements, which are described in the English *Miller*, consist in what is technically called the "wine process," and consists in forming a wine from malt by mashing, and afterwards setting up the vinous fermentation in closed vessels. Four gallons of the so-called wine is mixed with the necessary water for a sack of flour, drawn into a closed vessel, and aerated. It is then mixed with the flour (also in strong, closed vessels), and kneaded by arms driven by machinery. The dough formed is drawn off by machinery (thus dispensing with any intervention of the human hand) into the required loaf sizes, and at the same moment, as the carbonic acid gas passes out of it, the dough is raised and vesiculated, and ready for the oven, the whole time required for forming a sack of flour into loaves not being more than half an hour. The effect of the new wine process on the flour is, we understand, that the gluten cells of the starch are softened and broken up, and the dough is thus entirely altered in its character. Instead of being tough and harsh as formerly, the dough now becomes soft and elastic; it is easily kneaded, requiring only half the power to work the kneading arms, and the atmospheric pressure required in the vessels is only about 20 lbs. to the inch, instead of 90 lbs., as hitherto. The use of such low pressures, besides being a great pecuniary gain, is of considerable importance in giving to the bread a soft and beautiful pile-like texture.

The dough, when prepared by the new wine process, also soaks and bakes with the greatest ease, and at an oven heat of 100° less than the oven heat hitherto required for aerated bread. The starch of the flour is now changed into dextrin, while the gluten is uninjured; and the bread has a sweet and agreeable flavor, free from that acidity and bitterness always more or less present in fermented bread.

The Attendance at the Centennial Exposition.

The attendance at the Centennial Exposition for the one hundred and thirty-six exhibition days, ending and including October 14, aggregates 5,772,448 paying visitors, and 1,362,629 non-paying ones, showing a grand total of 7,088,077 people who have entered the grounds. The Philadelphia *Ledger*, whence we take the above figures, makes a number of suggestive comparisons between them and those representing the attendance at prior world's fairs. It appears that the pay admissions to the Centennial for the 136 days exceed the whole number of pay admissions at the Vienna show of 1873 for 186 days by 2,229,826, and the proportion of non-paying to paying visitors is far less. At the London Exhibition of 1851, 6,039,195 persons, paying and non-paying, attended in 141 days. Our Exposition already exceeds this by more than a million. At Paris, in 1855, the aggregate admissions were 5,162,330 in 200 days; and in London, in 1862, the numbers admitted were 6,211,103 in 171 days—both of which aggregates we largely exceed. At the 1867 Exposition in Paris, 8,805,969 people entered in 217 days. Judging from the present ratio of attendance, there is every probability that a million and three quarters will be added to the aggregate of paying visitors to the Centennial above noted, and a quarter of a million to the others, thus making over nine millions in all for 158 days, Sundays excluded, against the 8,805,969 for Paris in 217 days, Sundays included.

In its pecuniary results, the Centennial largely exceeds those of any exhibition yet held. The greatest return was at London, in 1851, namely, \$2,121,610; the next at Paris, in 1867, when it was \$2,103,677. The cash receipts for gate money during the 136 days of the Centennial were \$2,686,603.75.

ANTS.—A certain way to keep ants from sugar barrels, lard cans, and preserve jars, says one who has tried it, is to tie a string wet with kerosene around the barrel, can, or jar. Repeat the wetting of the string with the kerosene oil every few days.

THE HEMIPTERA OR BUGS.

The insects of the order *hemiptera*, or half-winged, include all those commonly called bugs, harvest flies, tree hoppers, plant lice, etc. They are sucking insects, having neither mandibles nor *maxilla* proper, but horny beaks curved along the breast when not in use, containing in grooves a series of delicate, sharp bristles, by which the insects puncture the skins of their victims. They have four wings, of which the upper are generally thick at the base and membranous at the ends, being as it were half *elytra* and half wings, whence the name of the order. In a few species, the wings are all membranous, and some are wingless as the bedbug. They undergo only a partial transformation, the *larva* and *pupa* resembling the adults, except in the absence of wings and in size; in all the stages they live in the same way, and are equally active. One species, the earth bugs (*geocoris*) have the *antenna* exposed and longer than the head; most are terrestrial, but some live on the surface of the water; many emit a disagreeable odor. The wood bugs or *pentatoma* occur mostly in warm countries, where they attain considerable size, and are marked with brilliant colors; they live on the juices of vegetables and sometimes on those of other insects; they exhale a disagreeable odor, and adhere to whatever they touch. The squash bug (*coreus tristis*) and the chinch bug (*lygaeus*) are species of this order.

Our illustration shows the *pentatoma grisea*, a family of the wood bugs, which may be seen, De Geer tells us, on the boughs of trees, the young following their parent like chickens after a hen. They are interesting to the entomologist on many accounts; but the gardeners find them by no means attractive. From June into autumn, the fifteen species of *pentatoma* are busy on cabbages and other vegetables, as well as on trees and flowers; vines, beans, and rosaceous plants fall victims to their fatal punctures in their search after sap. The wren and the chickadee are foes to these insects, and may do the farmer good service; but the chickadees have disappeared from many of our cities, owing to the pugnacity of the sparrows. Gardeners employ other remedies against these pests, tobacco fumigation and the application of whale oil soap being the best.

THE BURBOT.

The burbot, although a fresh water fish, is a member of the cod family, having the pendent barbs from the chin which distinguish most of the members of the *gadida* or cod-fishes. The burbot is ordinarily from 1 to 2 feet long, the head is flat and smooth, with the gape large, and the mouth filled with small teeth. The color is a yellowish brown, clouded and spotted on the sides, the belly being of a lighter hue. Like the eel, it conceals itself under stones, watching for young fish and insects, and it is very tenacious of life. The flesh is firm, white, and well flavored.

The *lota maculosa*, common in this country, is very similar in appearance and habits to the *l. vulgaris* above described, which is well known in England. Mr. Henry Lee relates, in *Land and Water*, that three of the common burbot were caught in the river Trent, and were offered to the directors of the Brighton Aquarium, and accepted; but before they could be despatched on their journey, the largest of the three (he was but 14 inches long) swallowed his two companions.

The burbot is very hardy, and, like the carp, will live for a long time out of water, if kept moist, and fed occasionally with worms and small fishes. It is said it will thrive in ponds if well fed on bullock's liver, etc. Its growth, however, is probably not very rapid, if the statement be correct that it does not spawn till its fourth year.

The large, three-lobed liver of the burbot has always been regarded as a great delicacy. Black tells of a certain Countess of Beuchlingen, in Thuringia, who spent the greater part of her income on this luxury. This liver was also supposed, according to Marsili, to be an efficacious "love philtre," and the oil from it was esteemed as a valuable emollient of corns and callosities. From the air bladder—small as it is, though large in proportion to the size of the fish—isinglass is made. The skin, cleansed, stretched, and dried, is used by the country people in many parts of Russia and Siberia instead of glass for the windows of their dwellings, and is as translucent as oiled paper. It is also utilized by some of the Tartar tribes as

material for their summer dresses and the bag in which they pack their animal skins. The fishermen of the Oder, when they catch more burbot than they can sell, cut the fattest of them into strips, dry them, and use them as matches. The roe, which, by Willoughby's computation, contains about 128,000 eggs, is deemed unwholesome, if not poisonous.

The turbot is also indigenous in almost all the rivers and lakes of Northern Europe, India, and Northern Asia, and also in the Hudson's Bay territories. It is common in Ger-

originality that his suggestion, of even so Utopian a scheme as the one above referred to seems at first sight to be, secures for it thoughtful consideration and possible reduction to practice, where otherwise it might merit but passing notice. Hygeia, as the model city of health is appropriately named, was described in a presidential address delivered by the author before the Health Department of the English Social Science Association, at the Brighton meeting of a year ago. This address, revised, is now published in pamphlet form.*

The population of the model city is placed at 100,000, living in 20,000 houses, built on 4,000 acres of land, an average of 25 persons to the acre. The safety of the population is provided against density by the character of the houses, which ensures an equal distribution of the inhabitants. No tall, overshadowing houses are permitted, and the height of edifices is limited to 60 feet, or four stories of 15 feet each.

The substratum of the city is of two kinds. At the northern and highest part there is clay; at the southern and southeastern, gravel. Whatever disadvantages might spring in other places, from a retention of water on a clay soil, is here met by the plan of building every house on arches of solid brickwork, through which there is a free circulation of air, and down the incline of which all currents of water are carried away. Three wide boulevards running east and west constitute the main thoroughfares; beneath each is an underground railway for heavy traffic. The other streets at right angles to the large avenues are all wide, and are planted at the sides with trees. Between the backs of the houses are gardens, and other gardens surround churches and similar large buildings which stand alone. No horse cars are to be allowed, the roads are paved with wood set in asphalt, and the pavements, ten feet in width, are of light gray or white stone. The accumulated dirt is daily washed into the subways and thence conveyed away from the city. There are no gutters; and in lieu of the foul sight and smell of unwholesome garbage, there are flowers and greensward. Nor are there underground rooms or cellars of any kind, the living part of every house beginning at the street level. The dwellings in all cases are of brick, glazed so as to be impermeable to water

The bricks are perforated transversely, and at the end of this there is a wedge opening, so that the walls in this way become honeycombed, and admit a constant body of air, which can be heated by the fire grates in the house. The bricks inside the house are decorated, so that no other finish is needed, and the layers of poisonous paper and moldy paste are thus avoided.

The chimneys are all connected with central shafts, into which the smoke is drawn after being passed through a furnace to destroy the free carbon, so that it is discharged colorless into the open air, and its nuisance thus obviated. The roofs of the houses are to be gardens, tastefully laid out. The kitchens, instead of being on the ground floor, are located in the garrets, so that no smell of cooking is ever dis-

seminated through the houses and the transportation of food is rendered easier, since the heavy dishes are taken down and the light, empty ones only carried up. No carpets are permitted, the floors being of hard wood, and kept clean by beeswax and turpentine, by which process the air is ozonized and rendered fresh. Twelve hundred cubic feet of air is allowed to each sleeper in bed rooms, and from the sleeping apartments old clothes, etc., are rigorously excluded. Lifts are provided for transporting material from floor to floor, and the heating apparatus consists in an air box in every room, which, distinct from the chimney, communicates by an opening into the outer air, and by another opening into the room. When the fire in the grate in the room heats the iron receptacle, fresh air is brought in from without, and is diffused into the upper portion of the apartment.

All pipes enter the houses from beneath; and as they pass through the arched subways, access to them is always convenient. The brick sewers run along the floors of the subways and empty into three cross main sewers. They are trapped in each house, kept well flushed, and ventilated into tall shafts by pneumatic engines.

As regards the personal habits of the population, drinking and smoking will be unknown, for saloons and tobacco-nists' shops will be excluded. Working men and women

*Macmillan & Co., N. Y. publishers



PENTATOMA GRISEA.

many, Denmark, Sweden, and Russia, and is especially abundant in the lakes of Geneva and Leman. If it be true that it was introduced into the former from Neuchâtel, and thence to Lake Leman, it furnishes a good example of successful acclimatization or naturalization. It is also met with in the Italian lakes Maggiore and Lugano, and exists in most of the streams in the east of France, but is not very abundant anywhere in that country. In England it is a local fish, being found chiefly in the northern and midland counties, and especially in the Trent. Mr. Couch suggests that the burbot may probably be an imported fish, and thus has not been generally distributed. From its tenacity of life we may conclude that it might easily be introduced into any deep and slowly moving stream; but, as it is a ravenous de-



THE BURBOT (LOTA VULGARIS).

vourer of small fry, as well as of fishes of larger growth, its presence in some rivers might not be desirable.

Hygeia—The Model City of the Future.

It has recently been announced that a site has been purchased in England whereon is to be erected a model city, conceived by Dr. B. W. Richardson. Dr. Richardson is well known as one of the first sanitarians living, a close and able investigator, and a man whose previous works are of such

will not be permitted to carry work home, but must hire workrooms in buildings set apart for that purpose. There is a great deal of good sense in this provision. Dr. Richardson says that work carried into squalid tenements is often a cause of the spread of disease. "I, myself," he adds, "have seen the half-made riding habit, that was ultimately to clothe some wealthy damsel, act as the coverlet of a poor child stricken with malignant scarlet fever." In order to avoid dissemination of disease by soiled linen, public laundries are established under municipal direction, and to these alone must be sent such clothing as is not washed at home. Public hospitals are established in various parts of the city. We have not space to enter into the details of these, and it will be sufficient to say that their planning is the result of Dr. Richardson's long experience in the great city of London hospitals. There are no insane asylums, and no poor houses; the few who would occupy such institutions are to be placed in houses licensed as asylums, but in no wise different from other buildings in the city. No persons are to be "badged and badgered as paupers," the author significantly remarks.

Of course the model city contains baths, gymnasia, public libraries, art museums, in brief all requisites for mental and physical culture. There is a municipal medical staff, under whose supervision every assumable disease and probable cause of disease is subjected to investigation. The sewage is conveyed to a farm and utilized; the water supply is uncontaminated and led always through iron pipes. An immense ozone generator makes ozone, which is "laid on" in private houses for disinfecting purposes. All animals for food and the modes of slaughtering them are under rigid inspection, and the killing is preceded by rendering the brutes insensible by passing them through a "narcotic chamber." Finally, there are no marked graves, no reserved spaces in cemeteries. The dead are buried in wickerwork coffins, which, with their contents, decompose and mingle with the earth. The only memorial monuments are tablets in a spacious covered hall or temple.

Dr. Richardson stops here, for he reaches the confines of his legitimate territory as a sanitarian. His plan, he says, will reduce the rate of mortality to 8 per 1,000 of the inhabitants for the first generation, and to 5 per 1,000 eventually. That this is a vast decrease is obvious when we compare this ratio with that of New York city, where, according to the latest statistics, the weekly mortality averages 82 per 1,000. But need we stop here? Certainly the inventor can step in where the hygeist ends; and may not this model city of health be the model city where are congregated the newest triumphs of inventive genius? There, perhaps, will be located the telegraph which, already in existence, enables us to transmit sound, and so hold converse over long distances, or to lead music into our houses as easily as the water or gas; there will be congregated all those wonderful automatic appliances which reduce the manual drudgery of housework to little more than mere supervision; in those underground railways, we may hope to see speed attained beyond all precedent, yet at no sacrifice of safety; there arms of metal controlled by electricity, by steam, by compressed air, by hot vapor, will relieve arms and muscles of flesh and blood; and then, physical labor being reduced to its minimum, may we not look for that cultivation of the intellectual man which shall lead to still greater attainments? Will not means be devised for developing our dual brain? May we not hope to use our left hand as easily as our right, our feet as advantageously as our hands, in all species of that which is now called handiwork? And then what higher race of men will be evolved by heredity, surrounded by such environment? Is not Dr. Richardson's Hygeia, after all, but the first step toward the rapid development of the future perfect man?

MINERALS AT THE CENTENNIAL.

Much disappointment has been expressed by many in not finding a better display of American minerals at the Centennial. We take an honest pride in the natural productions of our country, and perhaps we had expected too much of it, and hence the disappointment. Another cause of disappointment lies in the arrangement; there are a great many fine minerals scattered here and there, all over and in all the buildings, which, if brought together and systematically arranged, would make a fine show. The present arrangement, which is geographical, is of course the best for exhibitors, for each State and country gets due credit for what she exhibits; it is also the best for any one wishing to learn what may be the mineral wealth of a given State; it is interesting to those about to emigrate; but for the student of mineralogy, the order followed in our museums and technical schools is better.

THE MINERAL ANNEXE.

If we enter the mineral annexe at its eastern extremity, and pass down towards the Chinese exhibit of teas, figures, and curiosities, we find ourselves in the section devoted to the various States, beginning with that of Illinois. This State makes rather a poor show of minerals, with the exception of lead ores, especially of galena, of which there are some fine crystals, also calcite. The collection of antiquities from this State is, however, very fine. Next we see a large block of crude native sulphate of soda (Glauber's salt), some 4 feet square, from Wyoming territory. This block was taken from a deposit of 100 acres in extent and 10 feet thick, and appears to be quite pure. Pennsylvania follows, and its exhibit consists mostly of coal, iron, and oil, with some geological models, and a series of preparations made by Professor Schorlemmer, of Owens College, Manchester, England, illustrating the composition of petroleum.

Michigan is next, and far exceeds in interest any of the

above. Her specialties are native copper and silver, which are well represented here. First we see a cubical mass of copper, 3 feet on a side, which has been cut from a mass weighing 76 tons. Then we have ancient stone tools used by a prehistoric race for working the copper; copper minerals of different kinds; a conglomerate containing 5 per cent of copper; a large number of chlorastrolites, a green mineral peculiar to the Lake Superior region; native silver, and a set of miniature tools, like those now used in copper mining, made from the native silver and copper just as it comes from the mine; iron ore, and a geological section of the iron district; lastly an Indian canoe 10 feet long, made of birch bark.

The next State is Missouri, where lead and zinc abound. Here are some coal fossils of *lepidodendron*, also malachite, azurite, kaolin, geodes of amethyst, and other minerals. The zinc ores, from Dade county, and blende, from Joplin and Graten, are especially worthy of notice.

Ohio is chiefly noticeable for the mound builders' relics, a very large and fine display being made by the State Archeological Association, and another by L. M. Hoseas, of Cincinnati. Some of these indicate the possession of considerable skill and taste on the part of the extinct race that once inhabited that region. The building stones of the State are shown in the Ohio State building.

Next in order is Wisconsin, with her iron, lead, zinc, and copper. Here is a huge mass of smithsonite, or carbonate of zinc, which the miner calls dry bone, from its peculiar appearance. Here, too, are tools made of stone and of copper, which carry us back to prehistoric races.

Iowa is chiefly noted for its display of coal and lead. The geological formation is illustrated by a cabinet in which thin strips of the rock in each strata are placed one above the other, in cases 6 feet high and 18 inches wide. There are 12 of these cases, in which are shown all the various formations, from the St. Peter's sandstone up to the drift. Here for the first time are seen some skulls of the mound builders, also some large geodes.

Indiana exhibits kaolin in large quantities, also coal and iron ore. Delaware also exhibits iron and kaolin. The Schuylkill Company exhibit a block of coal weighing 14 tons 13 cwt., in this annexe, and here, too, is some statuary marble from Rutland, Vt., with photographs of the quarries. It seems surprising that so few mines, mills, or quarries have thought it worth their while to procure photographs of their works, for they both attract attention and impart, in an easy way, a deal of information.

The west end of this annexe is devoted to the Chinese and to some process for making artificial stone, by the aid of steam and carbonic acid.

In the smaller mineral annexe is a cabinet, showing a section, in miniature, of the Warrior coal measures of Alabama. The South Carolina exhibit embraces a model of the washers used in preparing nodules of phosphate of lime mined by the Charleston Mining Company on the Ashby river, S. C.

The most attractive exhibit in this building is that from Mount Union College, Ohio. It embraces a gorilla from Western Africa, a koala from Australia, an ant eater from Brazil, a kangaroo rat from Australia, and a *galeopithecus* from the Philippine Islands.

A few States, including Kentucky and Tennessee, have their exhibits in the United States Government building; others, New York among the number, have none worth mentioning. Kansas and Colorado have their minerals with their other products, including Mrs. Maxwell's animals, in their own State building. Colorado is particularly rich in minerals, and an enterprising dealer has constructed some toilet or jewel boxes, which he has covered with Colorado minerals, and these he sells in large numbers at the Colorado building. The prettiest of these minerals is the green felspar, known as amazon stone, which is found almost exclusively at Pike's Peak. Silver ores in abundance are also shown here, as well as tellurium minerals and many others less valuable or beautiful. About the door lay huge masses of silver ore and bituminous coal.

THE MAIN BUILDING.

Returning to the Main Exhibition Building, we find there a collection of Rhode Island minerals, very creditable to that little State; also some interesting relics, arrow heads, hatchets, etc., from the same State. There is a pretty good collection of Californian minerals, said to contain 17,000 specimens, number of species not stated.

From Maryland, we have some handsome *verde antique* marble, chromic iron sand from Delaware county, Pa., and crystals of bichromate of potash made from it.

The Passaic Zinc Company, of New Jersey, exhibit some fine specimens of calamine, also zincite and willemite, together with the metal made by them from these ores. The Corroding Lead Company exhibit pigs from the furnace, refined, soft, and desilverized lead, flake litharge, slag, skimmings, dross, regulus from matt, etc.

Joseph Wharton, Camden, N. J., makes the best and almost the only exhibit of nickel ores, ordinary nickel ore, pyrrhotite and millerite, and a set of salts, anodes, etc.

Not far from here is a model of a portion of an anthracite colliery, the Warton vein, Beaver Brook Pa., on a scale of 30 feet to the inch. The superincumbent strata being partially removed, the coal bed is exposed, showing the dip, synclinal, anticlinal, slopes, galleries, coal breakers, and other important parts, carefully labeled and intended for educational use.

There is a curious stone here from Mumford, Munroe county, N. Y., which consists entirely of vegetable petrifications, chiefly leaves and twigs. Although it looks very fragile, it must possess considerable strength, for we are told

that a church has been built entirely of this stone. Adjoining this is a large mass of infusorial silica, the so-called electro-silicon, from Nevada. This substance consists entirely of the siliceous remains of microscopic animals, and presents, when viewed under the microscope, many beautiful forms. Its chief uses are in the manufacture of dynamite, and as polishing powder.

Adjoining this again is a large and beautiful collection of American minerals, with a few foreign ones, exhibited by Professor A. E. Foote, of Iowa. Most conspicuous among these is the green amazon stone from Pike's Peak, Colorado. Then come some very powerful natural magnets, from Magnet Cove, Ark., a great variety of quartz crystals, single and in masses from the Hot Springs, a crystal of smoky quartz which is four feet long, from Pike's Peak, rose quartz, amethyst, petrified moss, green wavellite (unusually fine), native copper, petzite, atalactites and stalagmites, agates, landscape marble, etc. There is also a set of specimens put up for students' use, which embraces many rare minerals, and yet comes within the reach of almost every one.

In a cabinet by itself is a collection of minerals from the line of the Texas and Pacific railroad, also collected by Professor Foote. The most beautiful or rare are the turquoise and embolite (chromo-bromide of silver), from New Mexico, sylvanite (telluride of gold and silver), from Colorado, and moss agate, from Texas.

Iron and coal, as well as the precious metals, have been treated of elsewhere from an economic point of view; but we cannot refrain from calling attention to an unusually large, hollow mass of hematite iron ore, which constitutes a small cave with jet black walls, that look as if they had been varnished.

THE UNITED STATES GOVERNMENT BUILDING.

Carefully guarded in a fireproof safe are several of those exceedingly rare crystals, namely, pure gold. Not far from these are specimens of silver ore, valuable but not very beautiful, from Comstock and other celebrated lodes. Here, too, are many fine specimens of the purest sulphur, borax in abundance, and many other things which will be very valuable when civilization, now on its western march, shall have reached their hiding places. We also notice some large aerolites.

In cases against the walls are arranged some loan collections worthy of notice, especially those of Messrs. Jefferis, Perry, & Wilcox, of Philadelphia. One crystal of apatite, 4 or 5 inches long and 2 inches thick, was quite unequalled anywhere else. Mr. Fletcher makes a creditable exhibit of minerals from Bergen Hill, some of which are very beautiful.

CANADA.

The Canadian mineral exhibit is in the Main Building, and has been pronounced by competent judges one of the best on the grounds. Apatite, amethyst, native copper, iron, coal, and oil really deserve more notice than our space at present permits.

FOREIGN EXHIBITS.

Of the South American countries, Chili stands first. The collection of Emilio Escobar, embracing 445 specimens, is valued at \$30,000. It consists chiefly of native silver and silver ores, including several specimens of beautifully crystallized proustite or ruby silver (sulphide and arsenide of silver), from Chañarillo. Some of the crystals are over 3 inches long; the finest specimen is valued at \$4,000. The copper minerals are also very beautiful, especially the atacamite (chloride of copper), malachite (carbonate of copper), and many others; also cobalt ores, borates, sulphur, cinnabar, etc. The process of amalgamating silver ores is exhibited in a separate building, near the glass house.

Brazil and Mexico make a very fair show. The Mexican marbles, from their rare beauty, attract much attention. A single mass of metallic silver 6 feet in diameter, weighing 4,002 lbs., and worth \$72,000, attracts much attention from its value.

Russia is the only European country whose mineral exhibit fairly represents her mineral wealth. The exhibit from the Museum of the Imperial School of Mines is very fine. Beginning with native platinum and its associate metals, palladium, rhodium, iridium, ruthenium, etc., we next see some beautiful specimens of *aqua marina*, a bluish-green variety of beryl, emeralds, garnets, and zircons. Ouvarovite, an emerald green garnet, named after the Russian minister Uvarov, large pieces of jasper, nephrite, and topaz, in crystals 6 inches long, are some of the curiosities of the collection. The crystals of pure white rock salt, and of mica, are worthy of notice. Malachite, *lapis lazuli*, rhodonite, and labradorite, the great Russian specialties, are represented here; but a much finer display is made by Hoessrich & Woerffel, who exhibit a large number of articles made from these beautiful stones, such as vases, table tops, cabinets, mantlepieces and jewelry.

Practical Germany limits her mineral exhibit to products of use in the arts: amber, lead ores, petroleum, and Stassfurt salts. The collective exhibit of potassium and magnesium salts from Stassfurt is very complete, tastefully arranged, interesting, and instructive. Their discovery has created a revolution in the alkali industry, and it is now no longer necessary or profitable to destroy fine forests to obtain our supply of potash.

Great Britain makes a very poor show. Some bricks and tiles, chalk and cement, some polished granite from Aberdeen, and we have done. Italy is rather better, for she exhibits a fine collection of polished marbles, besides sulphur and alabaster.

The exhibit of Hawaii, although small, is very interesting, embracing as it does several sets of volcanic minerals and

lava from the crater of Kilauea. Among these is a bird's nest, made of pelee's hair, a substance resembling our mineral wool, and formed in an analogous manner, by the wind blowing over melted lava.

Diamonds in the rough, and diamondiferous soil with a diamond in it, are shown in the pretty little exhibit of the Orange Free State.

There are a few minerals scattered about elsewhere, but none of much value.

CENTENNIAL NOTES.

The Siamese exhibit, which has been six months on the way to the Exposition, has arrived, and is located in the Navy Department section of the Government Building. The collection was made under the direction of the King of Siam, and is a present to the United States. Whatever might have been its original condition, the present state of that portion of it which is visible is sad to behold. Under a covering of canvas there lie bundles of apparently broken parts of wags, a couple of rude wheels, dried palm leaves and other vegetable products, and a countless number of *et ceteras*, massed together and seemingly defying any attempt to resolve them into order. On the tables near by are displayed several curious peaked and pointed head dresses covered with spangles and gilding, and a collection of models of the long low snake-like boats peculiar to the Malays. All are tarnished and dingy, and the marks of a severe voyage and not over gentle handling are everywhere apparent.

THE GERMAN EXHIBIT

was so mercilessly criticised in the letters sent home by Professor Reuleaux, the chief German commissioner, that it has become rather the fashion to speak slightly of the display as a whole. This is decidedly unjust, for there are very many admirable features, amply sufficient to compensate for the over-abundance of effigies of Kaiser William and Bismarck, and the exhibit of cheap jewelry and chromos. For instance, there are Count Wernigerode's reproductions, in cast iron, of many famous works of art. These consist of helmets, shields, sword hilts, pitchers, urns, and plates, covered with exquisitely molded figures in bas relief. The casting is remarkable for its perfection in details, and will be quite a revelation to most foundrymen. One plate is left just as it was taken from the mold, with much of the sand still clinging to it, and the sharpness of outline attests the excellent work of both molder and founder. The objects are finished with a coating of brown powder, so that they cannot be distinguished by the eye from real bronze, while their cost is of course much cheaper. The ivory display is also very fine. Above the tall ebony case in which the objects are placed is a large pair of elephant's tusks, surrounded by smaller tusks, graduated according to length, and terminating in the short tusks of the walrus. Within the case are pianoforte keys, billiard balls, combs, chessmen, and a handsome collection of carved articles. A curious species of ivory is also exhibited in the long straight spiral horns of the narwhal or unicorn fish of the northern seas.

Germany gives to her pottery from the Royal Porcelain Manufactory, Berlin, the post of honor in the center of the building. To describe this superb display is scarcely possible, since the exquisite delicacy and artistic coloring of the ware render each piece an object of high art. Many of the vases are of very large dimensions, indicating the great skill brought to bear in their molding. The chemical exhibit in the German Department we have already described in other articles. Perhaps the most instructive contribution in the whole large display is one of the coal tar distillates and aniline colors, so arranged as to show the progress of invention in drawing from the dull heavy coal tar its oils, and then the beautiful shades of red, violet, blue, green, and orange, and finally that great triumph of the chemist's skill, alizarine or artificial madder, which surpasses the true madder root in brightness and fastness of color. The success which so far has rewarded investigators leads to the belief that the problem of manufacturing artificial indigo will be solved. One of the latest discoveries in the field of coal tar colors is eosine, which promises to supersede the costly cochineal.

There are three exhibitors of paraffin and mineral oil manufactured from peat. This industry is, in Germany, confined to Saxony, and the total annual value of the product is about \$4,000,000. The oils are mainly used for lubricating purposes, the poorer sorts alone being employed for the manufacture of illuminating gas and stearine candles. One very large block of stearine is exhibited, which is nearly a pure white. A large display is made of the famous Johann Maria Farina cologne. The descendants of Farina claim to be the only possessors of the secret of making the perfume. We shall describe other interesting German articles in future articles.

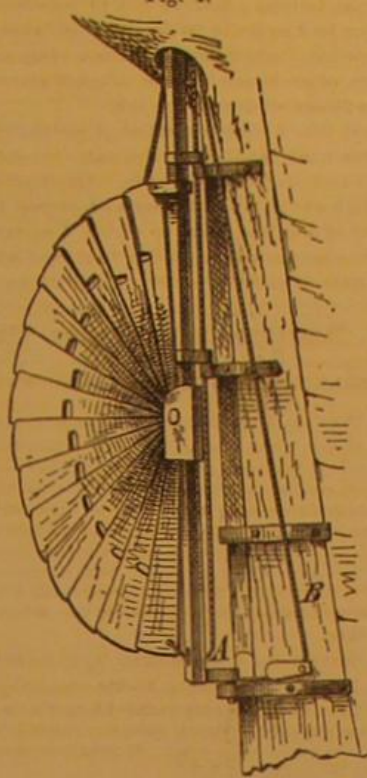
In the Italian section there is a model of

A NEW JURY RUDDER,

a sketch of which, Fig. 1, we give herewith. It is always customary for vessels to carry to sea the material for making a temporary rudder in case that very important appendage should become disabled, and there are many ingenious inventions for putting together spare spars and pieces of timber in rudder form. When the new rudder is made, however, the difficulty is by no means surmounted. The problem then is how to get it in place; and when a ship is rolling heavily in the trough of the sea, this is an exceedingly troublesome and perilous operation. The plan proposed by M. Raffaello Caglietti, of Ancona, offers first a simple construction, which is such that the device may be folded into a very small space, and so easily stowed; and, second, an easy means of shipping the rudder. The appliance is made of

heavy iron plates pivoted, like a fan, to a recessed block of metal at the center of an iron post, A. The upper plate is fast to the post and the others may be folded up beside it, so

Fig. 1.



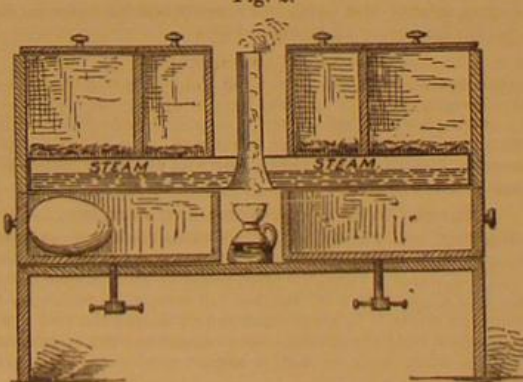
that when the device is thus placed it may be passed downward through the rudder hole. On the post are pintles which slip into gudgeons on the stern post, thus hinging the rudder in place. And also on the stern post is a sheave, B, through which a chain or rope is kept passed; so that, when it is necessary to place the rudder in position, one end of this rope is attached to the lower pintle, and by pulling on the other end the pintle is quickly drawn into the socket. In the lower part of the post, A, there is a sheave through which another rope, attached to the lower rudder plate, is rove, and which likewise leads up through the rudder hole. By pulling on this after the rudder is placed as described, the fans or plates are expanded as shown, while they may be closed to remove the apparatus by means of a rope shown on the opposite side.

In previous articles we have described the growing South African industry of ostrich raising, which, it has been suggested, might be successfully carried on in this country. In the annexed engraving is represented

THE LEVIATHAN INCUBATOR

(exhibited in the Cape of Good Hope section), wherein the huge eggs are hatched. The apparatus consists of a middle steam chamber of metal (Fig. 2), which is kept constantly

Fig. 2.



hot by a lamp or furnace beneath. Below this are drawers in which the eggs are first placed, and these, by means of the screws shown below, may be raised until the eggs are brought almost in contact with the warm surface above. In these receptacles the eggs are kept for two weeks at a temperature of 102° Fah. They are then removed and placed in the inner pair of compartments, shown above, for another

Fig. 3.



fortnight, at a temperature of 100°. At the end of this period the eggs are carefully extracted, and a small hole is chipped in each shell at the point opposite the chick's head. They are next replaced and kept in the same compartments for two weeks longer at 98°, when the hatching takes place,

and the young birds are placed in the outer upper receptacles, and there remain for two days. The compartments above, it should be noted, have bottoms of lamb's wool, which come in contact with the steam chamber below.

The two days' old chick is also represented in the engraving, Fig. 3, beside an egg, so as to show the relative size. The egg is about 7 inches in length and the bird some 13 inches in height. The chick is fed on rice, and when it reaches the age of seven days is worth \$50 in gold. Nearly 20,000 birds, we are informed, have been hatched at the Cape of Good Hope by apparatus of this description. The machine is frequently made of sufficient size to hold 115 eggs at a time.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned.

M. M.

Positions of Planets for November, 1876.

Mercury.

Mercury should be looked for before sunrise during October and the first half of November. On November 1, it rises about 5 A. M., and sets at 4h. 15m. P. M. On November 30, Mercury rises at 7h. 4m. A. M., and is too near to the sun to be seen.

Venus.

Venus is still brilliant in the morning, rising on the 1st at 2h. 58m. A. M., and setting at 3h. 15m. P. M. On the 30th, Venus rises at 3h. 58m. P. M., and sets at 2h. 45m. P. M. Although its apparent diameter is much smaller than in the summer, it is still a very beautiful object, and can be seen all through the month. On the 28th, Mars, at this time very small, can be recognized by its nearness to Venus.

Mars.

Mars is one of the planets visible to the naked eye, but it is very small in November, and can be seen only in the morning. It may be known from the circumstance of its keeping nearly the same diurnal path with Venus, at a little less altitude.

Mars rises on the 1st at 4h. 14m. A. M., and sets at 3h. 47m. P. M. On the 30th, Mars rises at 3h. 56m. A. M., and sets at 2h. 37m. P. M. On November 28 Mars and Venus will have nearly the same right ascension, and will pass the meridian with only a few minutes difference of time.

Jupiter.

Jupiter is very little seen in November. In the early part of the month it sets about 6h. 10m. P. M., and can be seen in the southwest immediately after sunset. On the 30th, it rises at 7h. 26m. A. M., and sets at 4h. 39m. P. M.

Saturn.

Although Saturn is low in altitude (in this latitude not above 26° for the whole month of November) it is much the most interesting object in the evening sky. With a telescope of low power, its wonderful ring can be seen, and at least one of its many satellites. On the 1st, Saturn rises at 2h. 16m. P. M., comes to the meridian at 7h. 30m., and sets at 43m. after midnight. On the 30th, Saturn rises at 23m. after noon, comes to the meridian at 5h. 38m., and sets at 10h. 53m. the next day. Saturn is among the stars of *Aquarius*, but so much brighter than even the brightest of the constellation as to be readily known to be a planet.

Uranus.

On November 1, Uranus rises a few minutes after midnight, but a short time before the bright star Regulus, and 14° north of it in declination. The planet can perhaps be found by its nearness to this bright star; it approaches the star until the 29th. On the 30th, Uranus rises at 10h. 15m. P. M., and sets at 11h. 58m. the next morning.

Neptune.

Neptune rises on November 1 at 4h. 41m. P. M., and sets at 6h. 1m. of the next morning. On the 30th, Neptune rises at 2h. 45m. P. M., and sets at 4h. 3m. the next morning. This planet is so far distant from the earth that it can be seen only by means of the best telescopes.

Sun Spots.

The report is from September 28 to October 17, inclusive. The photographs of September 28 and September 29 show two large groups of spots coming on. These were seen till October 3; but after that date, clouds prevented observation and photographing till October 9, when the sun's disk appeared to be free from spots. On October 13 a group of small spots was seen on the western limb. These had not been discovered before, probably on account of clouds. This group was last seen on October 17, but, contrary to the usual behavior, it had appeared to increase in size as it approached the limb. The return of this spot may be looked for after two weeks.

Small Arms for Russia.

Smith & Wesson, Springfield, Mass., have a new contract with the Russian government for 20,000 pistols, which are to be the same as those they have making, and include the automatic ejector. The firm have now manufactured some 130,000 for this government, their first contract being taken in 1871. This contract, by the way, was concluded for the government by a gentleman bearing the euphonious name of Captain N. Kouschavewitch.

THE Australian gum tree, *eucalyptus globulus*, well known for its antiseptic qualities, has recently been found to yield a fragrant resinous oil, containing a substance homologous to camphor.

Patent Law Reform in England.

At a recent meeting of the British Association at Glasgow, a paper was read "On Recent Attempts at Patent Legislation," by Mr. St. John Vincent Day. In the discussion which followed, Mr. F. J. Bramwell spoke at some length. It seems to be thought, he said, that lawyers have a special claim to dominate in patent legislation, perhaps on account of the great gravity of the legislation which arises out of patents. This notion of excessive litigation in reference to patent matters is absolutely unfounded. An eminent barrister connected with patent litigation, when it does arise, had assured Mr. Bramwell that on an average of many years only nine patent actions or suits go to the stage of a primary decision in each year; and an examination of the files of the *Times* for the year ending November, 1874, showed the accuracy of the statement which had been made. Mr. Bramwell then proceeded to the question of the official examinations into novelty and frivolity. He had long had very great doubts whether it is desirable to make an examination even into novelty; but if such an examination be made, the very first care must be to appoint a sufficient number of men of scientific attainments or of good experience. This is a difficult task in itself; even when the greatest care has been taken, it is certain that some mistakes will be made, and some hardships will be suffered, and we have to consider whether the advantages to be attained are sufficient to justify the risk. After all, what is the benefit to be derived from an examination into the novelty of an invention? Sometimes, it is said, it is to protect the inventor. The answer to that is that, if you make the inventors into classes separate from the community at large, the inventor says: "For heaven's sake, leave us alone; we do not need to be protected against ourselves." But others put the desirability of the examination into novelty on broader grounds. They say it is undesirable that a patent should be granted for a thing which is not new, because the public may thereby be prohibited from using something which the patentee claims as his invention. The answer to this is that a patent granted for a thing which is not new is, if not void, voidable, and then in truth a very small amount of harm results. Mr. Bramwell then went on to illustrate his meaning by reference to the inventions of James Watt, Dr. Potts (the inventor of the method of driving piles by the exhaustion of the air), and Dr. Siemens, all of whom he urged would, probably, have been refused a patent, by the examining body. It appeared certain that we should not have an examination as to frivolity; and if we were to have an examination as to novelty, that examination should be fenced with precautions to prevent an inventor being injured by a wrongful decision. It was recommended by the committee of the Society for the Amendment of the Law that a patentee should have, notwithstanding the adverse report of the examiner, a right to demand his patent if he still so pleased, but that the specification should have appended to it the decision of the examiner, and that any person bringing an action under such a patent should be compelled to give security for the costs; and that in the event of his failing, and failing on the grounds put forward by the report of the examiner, he should pay the whole costs of his opponent as between solicitor and client, and not the mere taxed costs. Some protection such as this against the mistake of novelty examiners was absolutely necessary.

REMARKS.—In this country we have had the system of official examination in vogue for forty years; and if it were possible for Englishmen to learn anything, they might profit from our experience. In the early days of our system, it was the common practice of the Patent Office to reject even highly meritorious inventions; just as they now do at the Prussian Patent Office. But that method gave great dissatisfaction, and was so discouraging to inventors, and so obviously contrary to the spirit of the Constitution, that it had to be abandoned. At present the examinations are substantially limited to the ascertainment of identities of inventions. If the invention for which a patent is asked is identical with one already patented, the petition is rejected. If there is an iota of difference, the new patent is allowed. This is the only safe rule to follow; it works well, and gives satisfaction; except in cases where the examiner is so stupid as to be unable to see the difference between tweedle-dum and tweedle-dee. Property in patents never commanded such high valuations here as at present, notwithstanding the fact that the number of issues, now nearly 15,000 a year, is steadily increasing. The Supreme Court of the United States taught our patent officers a good lesson concerning the necessity of liberality to inventors, when it forbade the practice of citing old rejected cases against new applicants. This decision so limits the scope of official examinations that they are of no special importance now, if indeed they ever were; and nobody would be hurt if the system were abrogated. We agree with Mr. Bramwell that a patent granted for an old invention is good for nothing, and the issue of such a patent does very little harm.

Chromic Inks.

As long ago as 1848, Professor F. Runge invented what he called a chromic ink, from its containing chromate of potash. His directions for its preparations, published at the time in *Dingler's Journal*, were as follows: A decoction of logwood is first made in the proportion of 10 to 80, that is 10 lbs. of logwood is boiled with enough water to produce 80 lbs. of the decoction. To 1,000 parts of this logwood extract, when cold, is added 1 part of yellow chromate of potash, stirring rapidly. It is ready for use at once. Gum and other additions are injurious, he says, to this ink.

The following year W. Stein proposed an improvement on Runge's ink, saying that the great fault of this ink was that it soon became thick, like sour milk. This he overcame by adding four grains of corrosive sublimate to each bottle.

This would restore thick ink to its pristine quality, and improve its color changing it from deep indigo blue to pure black.

In 1867, C. Puscher described a new ink similar to the above, made as follows: Boil 10 ozs. of logwood in 20 ozs. of water, then boil again in 20 ozs. more of water, and mix the two decoctions; add 2 ozs. of chrome alum and boil another quarter of an hour. One oz. of gum arabic is added, and we have 25 ozs. of deep black ink.

Böttger says that a simple method of preventing gelatinizing in chromic ink is to add to the water in which the extract is made some carbonate of soda. His method of operation is as follows: Dissolve 15 parts of extract of logwood in 1,000 parts of distilled water to which 4 parts of carbonate of soda has been added at boiling heat, and add 1 part of yellow chromate of potash dissolve in a little water.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED SHOVEL-GRINDING MACHINE.

William A. Meyer, North Easton, Mass.—This consists of a series of swinging shovel-blank-supporting frames, that are journaled in a shaft placed on pivoted and spring-acted standards. The blank holding frames and standards are supported on a traversing carriage that feeds the blanks successively to a rapidly revolving and adjustable grindstone, that grinds the entire surface of the blanks. There is a revolving eccentric cam, supported on a pivoted and sliding carriage, which is capable of being moved toward or from the shovel frames, as required, by the articles to be exposed to grinding.

IMPROVED BOAT-DETACHING APPARATUS.

William A. Brice, London, England.—This detaching apparatus remains intact and locked as long as there is strain on the suspended rings, but is instantly released when the strain is taken off by the raising of the boat by the wave. It was described and illustrated on page 150, volume XXXV.

IMPROVED MACHINE FOR SAWING STAVES.

Benjamin H. Catching, Forest Grove, Oregon.—A band saw, or a saw of similar form in two parts, is fitted on an oscillating circular head, on each side of which is a saw table and feed carriage. The carriages are worked by weighted cords, and the saw tables have grooves in the under side for guiding the work to the saw, the guide being shifted from groove to groove as each stave is sawn off. A special advantage is that one part of the saw cuts while the other part is on the back stroke.

IMPROVED REVOLVING EARTH SCRAPER.

Benjamin Slusser, Sydney, Ohio.—This invention relates to certain improvements in revolving earth scrapers designed for general purposes of excavating and moving dirt; and it consists in the particular construction and arrangement of the scraper proper, made of a single sheet of steel bent so as to secure the best results in lightness of draft and perfection of filling, and provided with racking runners and an end board of peculiar arrangement, intended to improve the operation and increase the durability of the device. The invention also consists in the improved arrangement of the scraper with respect to its frame, the said scraper being pivoted therein upon double pivots, which are shifted from the front to the rear of the center of gravity, according to whether the load is to be transported or the scraper dumped by revolving.

IMPROVED NAIL PLATE FEEDER.

Rollin Van Amburgh, Wetmore, Kan.—The novel points of this feeder rest in the construction and arrangement of the devices attached to the barrel for feeding the nail plate to the knife, and in the means for reversing the barrel before applying its tapered mouth to the knife, which reversing movement is effected through the instrumentality of a band, and a reciprocating block moving on a spirally flanged or auger-shaped shaft.

IMPROVED CAR COUPLING.

Samuel Hamer, Salt Lake City, Utah Ter.—This combines a buffer arrangement with the drawhead and coupling. It consists of a spring-acted drawhead, with interior separately movable drawbar, to which a coupling spring hook is pivoted. The drawhead has a top shoulder that comes in contact with an auxiliary spring bolt, and acts as a buffer head.

IMPROVED HAY ELEVATOR AND CARRIER.

Joshua Anderson, Short Creek, Ohio.—This invention consists in the construction of the carriage and its arrangement to the track or way upon which it runs, the same being so constructed and arranged that the elevation of the load of hay in the fork trips the carriage and allows it to move upon the ways, and the load is held in its position near the carriage by a retaining device independently of the draft rope, so that it cannot sway to the floor again when the carriage is set free.

IMPROVED ANVIL.

James Jenkins, Cortez, Nevada.—This inventor has devised a means of repairing old and worn-out anvils cheaply, and thereby economizing metal, now lost when the face is worn down so as to be unfit for further use. It consists of a steel face and swage block, secured on the top of the anvil by a metal strap, screwed detachably to its sides, and fitted down the sides and under the bottom of the anvil, to which it is fastened. Keys are fitted between the block and the hollow face of the anvil, to support it firmly. The connection of the attaching strap to the sides of the block is such that the block can be reversed to use one side for the anvil face, and the other side for the swage block.

IMPROVED RESAWING MACHINE.

Thompson M. Newman, Gallatin, Tenn.—In this device, a rotary saw on a vertical arbor is arranged between two tables which are supported on screws so that they can be shifted up and down to vary the thickness of the stuff. They may also be inclined to the saw for sawing bevels, and have feed rollers geared by counter-shafts and belts, with the main horizontal driving shaft mounted in the lower part of the frame and turning the saw arbor by bevel gears.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED MACHINE FOR CURLING FEATHERS.

Johann Hawlowetz, New York City.—This consists of a revolving curler, in connection with an apron running over a driving roller, an adjustable stretching, and a swinging and spring-acted roller.

IMPROVED HEEL EVENER FOR BOOTS AND SHOES.

Abram Dille, Drakestown, and John L. Larrison, Schooley's Mountain, N. J., said Larrison assignor to said Dille.—As an improved heel evener for shoes and boots, that may be readily set to keep the heel level for any tread of the foot, the inventor provides two wedge-shaped rubber plates, that are applied by a center pivot to the insole and heel, and adjusted by upward projecting side lugs at their thickest part.

IMPROVEMENT IN PURIFYING IRON AND MAKING STEEL.

John L. Randall, Albany, N. Y., assignor to himself and Stephen Munson, same place.—This consists in treating molten cast iron, while in a receiver, with pulverized titanite or equivalent iron ore, potassic ferrocyanide, and potassic nitrate. The process allows of using old as well as new material, utilizing refuse metal the vitality of which has been nearly destroyed, restoring it to a high standard of excellence. By the said combination of materials also a superior and uniform grade of metal, suitable for extra fine castings, is produced, which may serve as a substitute for steel.

IMPROVED COMPOSITION FOR ARTIFICIAL MARBLE.

Louis De Planque, New York City, assignor to himself and Francis Strom, same place.—The composition consists of plaster of Paris dissolved in whey, under admixture of starch, glue, and sulphate of zinc. The mass is cast and pressed into molds, in which it remains a few hours until completely hardened. It is taken out of the molds when hard and polished. Any imitation of marble or other stone may thus be produced.

IMPROVED SHOW CARD FOR BUTTONS AND LIKE ARTICLES.

Charles A. Richter, New York City.—The buttons are attached to small cards, each card holding one dozen buttons. The cards have pointed ends which slip into slits in the large supporting card.

NEW HOUSEHOLD INVENTIONS.

IMPROVED MOSQUITO NET FRAME.

Edward S. Lathrop and Louis Salvaterra, Savannah, Ga.—This mosquito net frame is designed to be applied to a bed or crib, and adapted to be extended with a mosquito netting canopy, which it carries across the bed to protect the occupants. It may also be readily drawn back by the occupants while in bed. It consists mainly of a pair of lazy tongs, one on each side of the bed, and so combined with a supporting standard, attached to the bedstead and the mosquito netting, that the latter may be readily extended across and enclose the upper portion of the bed, or be drawn to one end of the bed and out of the way.

IMPROVED WINDOW MIRROR.

Carl A. Demling, New York City, assignor to Anthony Demling, same place.—This is an improved reflecting mirror for the windows of buildings, by which the street in both directions and the door of the house may be observed by a person sitting at the window without the necessity of leaning out. It consists in connecting window mirrors to a sliding sleeve by a ball and socket joint, so as to make them adjustable in any desired direction.

IMPROVED BOSOM-IRONING BOARD.

Luther A. Van Kuren, Binghamton, N. Y.—In this device, the bosom is, by means of a swinging bar, readily stretched to the required degree of tension, and tightly held for being ironed until released by the raising of the bar.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WAGON END GATE.

Zaccheus C. Wilson, Nokomis, Ill.—The object here is to furnish end gates for wagon bodies, so constructed, for convenience in dumping grain, that they may be opened and put out of the way without being detached from the said bodies, and in such a way as to leave the open ends wholly unobstructed. When closed they are firmly held in place, so that they cannot be pressed open by the load.

NEW AGRICULTURAL INVENTIONS.

IMPROVED SEED PLANTER.

William F. Finney, East Castle Rock, Minn.—This machine, for planting corn, beans, sorghum, broom corn, and other seeds, is so constructed that it may be readily arranged to plant the seeds at any desired depth, that the plows may be easily raised from the ground, and so that the operating mechanism may be readily thrown into and out of gear with the driving wheel.

IMPROVED COTTON AND CORN PLANTER AND FERTILIZER DISTRIBUTOR.

William Scott, Fredericksburg, Va.—The invention consists in attaching two or more adjustable hoppers to a main shaft composed of two opposite equal arms, connected and made extensible by a central sleeve provided with a slot and clamp screw. Said main shaft has its bearings in vibrating side bars, pivoting at their front ends on the inner surfaces of the side bars of the main frame of the machine, and their free rear ends controlled by limiting pins fixed to said main frame, which is extensible longitudinally, and provided with the usual shovels, coverers, handles, and marker.

IMPROVED STRAW CUTTER.

Amasa Heverly, New Albany, Pa., assignor to himself and Philo Mingo, of same place.—In this cutter the knives are made with convex edges, and are attached to a bevel-toothed wheel running against the mouth of the cutter box. Springs are attached to the inside of the cutter box at a suitable distance back of the cutters, and converging toward, and terminating a little in advance of, the cutters, to open and close on the material being cut according to its volume, and to confine it mostly at the middle of the range of the cutters. Through this arrangement it is claimed that the machine works better and easier than when the box is open across the whole breadth, while the stalks are free to be urged away to the outer portion of the cutters.

IMPROVED COMBINATION AGRICULTURAL TOOL.

Maynard Reynolds, Manchester Depot, Vt.—This is an improved shank, so constructed as to receive and securely hold a hoe, a weeding hoe, a potato hook, and a rake, in such a way that the said tools may be attached and detached by simply tightening and loosening a screw. A hoe, a narrow weeding hoe, a potato hook, and a rake are designed to be made and sold with the handle. By this construction, by simply loosening a hand screw, either of the tools can be detached, and another inserted in its place, so that the farmer or gardener need buy but one handle or shank for a set of tools.

IMPROVED DEVICE FOR PICKING COTTON.

Richard A. Cuthill, Shreveport, La.—The process of picking cotton by hand is slow, tedious, and expensive, and machines for the purpose have failed to come into extensive use, first on account of their cost, and secondly their imperfect operation. The patentee has therefore devised a cheap but efficient means for facilitating hand picking, and the same consists of gloves or other hand coverings, provided with fangs, hooks, or claws, by which the cotton may be rapidly removed from the bolls. To free the cotton from the fangs or claws, a brush is provided, the same being attached to the body of the picker, in a convenient position to allow the gloved hands to be passed across and in contact with it. The cotton, thus removed from the fangs by the brush, rolls off and falls into a bag or basket, which is also strapped to the body of the picker.

The AMERICAN CENTENNIAL, 1876
Wheeler & Wilson Victorious!

Again the WHEELER & WILSON Sewing Machines triumph over the world. The Centennial Commission have officially announced the awards, and decreed for the new Wheeler & Wilson Machine two Diplomas of Honor and two Medals of Merit. This is a double victory, and the highest award which it was in the power of the Centennial authorities to bestow. No other sewing machine received such a recognition. More than thirty of the best producers of machines in this and other countries entered for competition, and at Philadelphia in 1876, as Vienna in 1873, and at Paris in 1867, Wheeler & Wilson lead the list. After a careful, rigorous, and exhaustive examination, the judges unanimously decided that the superior excellence of these machines deserved more than one medal or diploma, and, consequently, they recommended two of each. The Centennial Commission unanimously ratified the action of the judges, and the public will endorse the decision of these ablest of mechanical experts. A claim of equally distinguished honor for any other sewing machine is only an attempt to hoodwink the people. Read the following, which stamps the "New Wheeler & Wilson" as the *Standard Sewing Machine of the world*.

[From the Official Report.]

AWARDS TO WHEELER & WILSON.

1. A Medal and Diploma for "The New Wheeler & Wilson Sewing Machine," for the following reasons:

"A Lock-stitch Sewing Machine unsurpassed in the fine workmanship of its parts, great originality, great adaptability to different kinds of work both in cloth and leather, beauty of stitch, ease and rapidity of motion, and completeness of display."

2. A Medal and Diploma for "The New Wheeler & Wilson Sewing Machine" for Leather, for

"Superior quality of work in Leather Stitching."

[Exchange.]

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

7,000 lbs. per hour. Ore reduced in 9 ton Pulverizer! Illustrated circulars. Farrelly Aiden, Pittsburg, Pa.

Agricultural Implements and Industrial Machinery for Export and Domestic Use. R. H. Allen & Co., N. Y. Town and Village Hand Fire Engines, with hose carriage and fittings, only \$350. Send for cuts and full information. S. C. Forsyth & Co., Manchester, N. H.

Grain Driers—Parties who use them extensively will please send address to Hersey Brothers, cor. 2d and E Streets, South Boston, Mass.

Magie Lanterns, Stereopticons, and Pictures for Parlor Entertainments and Public Exhibitions. Pays well on small capital. 74 Page Illustrated Catalogue free. Centennial Medal and Diploma awarded. McAllister, M'F'g Optician, 49 Nassau St., New York.

Wanted—Lathe, 48 in. swing, heavy, short bed, new or good 2d hand. Hull & Belden Co., Danbury, Ct.

1,000 New Sewing Machines, Lock Stitch, handsome and attractive. Closing business. Will exchange all or part for Machinery or Merchandise. D. S. M. Co., Danbury, Conn.

Noiseless Exhaust Nozzles for Exhaust Pipes and Pop Valves. T. Shaw, 915 Ridge Ave., Phila., Pa.

Must be Sold, and at a Bargain, for Cash—A Steam Wagon or Motor, belonging to an Estate. Address J. H. Kenyon, Plainfield, New Jersey, where it can be seen, or W. S. Combs, St. Paul, Minn.

Shop Stoves—Brazil Foundry, Brazil, Indiana.

Boiler Punch Lathes, 9 ft. Planer, Brooks & Wabrener, 261 North 3d St., Philadelphia, Pa.

Fire Hose, Rubber Lined Linen and Cotton, finest quality. Eureka Fire Hose Co., 13 Barclay St., New York.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocom & Son, Drinker St., below 147 North Second St., Philadelphia, Pa.

At a Bargain—Centennial Exhibition Shafting. Four lines of 2 1/2 and 3 in., complete. 65 ft., 105 ft., 120 ft., and 170 ft. A. B. Cook & Co., Erie, Pa., or D. 9, 72, Machinery Hall.

For 13, 15, 16 & 18 in. Swing Engine Lathes, address Star Tool Co., Providence, R. I.

The Scientific American Supplement—Any desired back number can be had for 10 cents, at this office, or almost any news store.

Latest and Best Books on Steam Engineering. Send stamp for catalogue. F. Keppy, Bridgeport, Conn.

D. Frisbie & Co. manufacture the Friction Pulley—Captains—best in the World. New Haven, Conn.

500 new and second hand machines at low prices, fully described in printed lists. Send stamp, stating just what you want. S. C. Forsyth & Co., Manchester, N. H.

Patent Scroll and Band Saws, best and cheapest use. Cordesman, Egan & Co., Cincinnati, Ohio.

Chester Steel Castings Co. make castings twice as strong as malleable iron castings at about the same price. See their advertisement, page 301.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., 80 Newmarket, N. H.

Water, Gas, and Steam Pipe, Wrought Iron. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

For Solid Wrought-Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 259 W. 27th St., N. Y.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 520 Water Street, New York.

Lathe Dogs, Expanding Mandrels, Steel Clamps, &c., for Machinists. Manufactured by C. W. LeCount, 80, Norwalk, Ct. Send for reduced Price List.

Driving Belts made to order, to accomplish work required. Send full particulars for prices to C. W. Army, 148 North Third St., Philadelphia, Pa.

Power & Foot Presses & all Fruit-can Tools. Ferracute Wks., Bridgeton, N. J. & C. 27, Mch. Hall, Cent'l.

The "Abbe" Bolt Forging Machines and the "Palmer" Power Hammer a specialty. Send for reduced price lists. S. C. Forsyth & Co., Manchester, N. H.

Seamless Bag Machinery.—Send Circulars to Andrew Dow, 277 Madison St., New York.

"Dead Stroke" Power Hammers—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 20 per cent. Hull & Belden Co., Danbury, Ct.

Steel Castings, from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Burring Metals. E. Lyon, 470 Grand Street, New York.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Shingle, Heading and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.



Will G. W., of New Haven, Conn., who observed the shock of the Hell Gate explosion, let us know if his watch was keeping New Haven time, and if, subsequently to the explosion, he ascertained the error of his watch?—W. W. W., of St. Louis, Mo., should consult an expert.—C. N. B. will find a description of a sun dial on p. 469, vol. 29.—G. L. W. will find directions for making Vienna yeast on p. 185, vol. 30.—A. B. will find directions for soldering gun barrels together on p. 353, vol. 27.—A. T. L. will find directions for annealing glass chimneys on p. 42, vol. 26.—J. B. can waterproof cardboard by following the directions on p. 17, vol. 33.—C. A. W. will find directions for polishing gun barrels on p. 11, vol. 32.—E. B. H. will find directions for lacquer on iron on pp. 243, 312, vol. 34.—M. G. will find directions for gliding without a battery on p. 116, vol. 32.—J. R. B. will find directions for making salicylic acid on p. 324, vol. 32.—M. will find directions for kalsomining on p. 351, vol. 34.—H. D. O. can clean the silver rims of his show cases by the process described on p. 251, vol. 33.—A. R. can use celluloid as a substitute for wood in inlaid work. See p. 23, vol. 33.—A. T. T. will find an answer to his query as to the cannon on a car on p. 273, vol. 32.—A. S., who does not give his name or address, will find that the proportions of wagon axles are given on p. 299, vol. 34.—I. R. C. will find a recipe for indelible ink on p. 129, vol. 28. A good recipe for a soldering fluid is given on p. 251, vol. 28. For a cement for mending china, see p. 379, vol. 31. For a cement for leather, see p. 119, vol. 28. For a silver-plating solution, see p. 408, vol. 32.—C. A. K. will find directions for transferring prints to wood on p. 138, vol. 30.—W. F. S. will find a full explanation of the processes for refining petroleum on p. 340, vol. 26.—F. B. will find a description of a magnetic engine on p. 241, vol. 33.—J. A. S. will find full descriptions of plans for lacing belts on p. 244, vol. 34.—F. N. P. will find a description of the paper process of stereotyping on p. 363, vol. 30.—G. H. P. will find directions for bronzing on brass on p. 51, vol. 33. For blacking brass, see p. 362, vol. 25.—S. G. C. will find a description of the century clock on p. 688, vol. 2. SCIENTIFIC AMERICAN SUPPLEMENT.—A. P. H. will find descriptions of several ice machines on p. 40, vol. 35.—G. W. A. should try some of the anti-incrustators advertised in our columns.—J. K. will find directions for putting a white enamel on watch dials on p. 107, vol. 30. For gold dip for brass, see p. 116, vol. 33. For silvering brass, use the solution described on p. 408, vol. 32. For black surface on brass, use the process given on p. 362, vol. 25.—O. Z. will find a recipe for stove cement on p. 183, vol. 34.—W. B. W., E. T. H., J. C. W., J. S. J., G. A. W., D. C. S. P. F., A. L. N., R. N., W. M., and many others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) F. G. asks: How do manufacturers make the stain with which they finish tool handles, etc., of a bright yellow? A. Use raw linseed oil 1 gill, dragon's blood and yellow ochre equal parts, and enough to color the oil; mix together, and rub on with a clean rag. Let stand for 3 or 4 days, give a coat of the oil only, lay by for a week, and polish with a dry rag.

(2) N. P. M. says: It is a principle in heating and ventilation for cold air to fall and heated air to rise; with this principle in view, how can it be possible that the higher above the earth we go, the colder is the air? A. The atmosphere is supposed to be about 50 miles in height and lies in various strata of different densities, the heaviest nearest to the earth. There is a theory that the sun's rays are not necessarily charged with heat and light, but that these phenomena are generated by the friction or union of said rays with the particles of the air or with grosser material objects. According to this theory, the denser the air the greater the friction, and consequently the greater the prevalence of heat near the surface of the earth. Heat, it is true, has the property of expanding air, and through this means there are continually ascending currents; but this action is limited, for being soon deprived of their heat by the cooler strata they meet with, they eventually find the position proper to their natural density. The same effect is observed in the air confined in a room; the warm air rises, is cooled, and falls to the floor, and upon being again warmed repeats the course. Indeed, by observing the bubbles of air in boiling water, we are furnished with an ocular demonstration of this action.

What produces sudden cold spells in our climate? A. The changes from heat to cold and the reverse action, which are so common in our climate, are no doubt frequently caused by the great agitation of the air currents, when seeking to form an equilibrium in the temperature of the great body of air surrounding the earth. But there are occasions when these sudden changes

do not seem to be fully accounted for by this cause, when the air seems to glow with heat; and these may be attributed to electrical and magnetic currents, a knowledge of the action of which we have not yet fully mastered.

(3) M. G. asks: Is it proper to call the copper wire enclosed in gutta percha, that they used in blasting at Hell Gate, a fuse? A. No. The fuse is the tube containing the cap and a quantity of some explosive.

(4) E. W. T. says: 1. Is there electricity on telegraph wires when all the keys except one are closed? A. If there is a battery connected with the wire, the wire will receive a charge from the battery even if a key be open at some other point on the line. There would be no current, however, unless the keys were all closed. 2. Are telegraph wires (on account of their connection with batteries) more liable to be struck with lightning than other wires of equal height? A. No, not in the slightest degree.

(5) L. G. ask: Have the last observations on the transit of Venus been reduced, so as to determine the sun's parallax? A. We believe that two or three have been reduced as an experiment to see what the result would be; but it was not materially different from that now used by the Bureau of Navigation, which is 8"44" as the sun's mean horizontal parallax.

(6) H. C. G. asks: What can I put in flour paste to prevent its souring and not injure it? A. Brown sugar, corrosive sublimate, and oil of lavender.

How many gallons water does a 20 horse power steam boiler use per hour, at moderate speed? A. That depends upon what kind of an engine it is supplying. In ordinary practice, it would range from 50 to 250 gallons.

How far from the reservoir can a steam pump be situated to work well? Can it work well at 375 feet distance? A. It can be made to work at this distance, with a suction pipe of ample size, carefully laid.

(7) W. J. M. asks: Will steam, passing in jets between the piston rings and cylinder of an engine cease the cylinder? A. Yes.

(8) E. B. C. says: I have two cells of gravity battery. How much will a magnet made of 1 lb. of No. 10 copper silk-insulated wire lift? A. You cannot lift much with two cells of gravity battery, nor with helices made of No. 30 copper wire. If you want to lift heavy weights by electricity, cover your iron cores with No. 14 copper wire—using 150 feet—and employ a dozen of the large size carbon cells. The horseshoe form is best, with an armature.

(9) H. H. B. asks: What size of wire do I want for winding telegraph magnets for a resistance of from 1 mile to 12? A. The wire should be copper, No. 30 gage. 2. How should it be wound? A. It must be wound in layers, as close together as possible. The best plan would be to buy one already wound, as they can best be wound by machinery and can be bought at small expense. 3. Should the wire be insulated from the magnets on which it is wound? A. It should be insulated with silk.

(10) J. L. B. says: I have a short telegraph line about 1/4 mile in length. I have 3 learner's instruments on different points on the line. It takes three cells of the Daniell battery to work it. My experience is that with a closed circuit the battery gets weaker, or, as operators say, runs down. The batteries require cleaning and use more sulphate of copper and zinc (thus the expense of battery is greater) when circuit is closed. I have arranged a battery at each instrument with a switch, so that I can cut each battery in the line and work it; then cut off the battery and leave the line closed, grounded at each end of course, and in circuit in such a way that an operator at either instrument can cut his battery in the line and work it, and then cut the battery out of line and leave the instrument in. In this way we only have circuit while working, that is, only half an hour or so each day. Which is cheapest, to keep up 3 cells with closed circuit, or 3 in the way in which I am working? A. That would depend upon how much of the time you used the line. If you used it constantly, one battery and a closed circuit would be the cheapest. If you only used it occasionally, the plan you have adopted would be the cheapest.

(11) P. E. I. asks: Are there any methods, other than those laid down in works on navigation, for determining the rising and setting of the moon? A. There are other methods, but we know of none better.

(12) F. T. says: There are four lithographic presses, resting on corks, at work on the fourth floor of a brick building, the rumbling of which does not annoy the artists on the floor below. Since they have been removed into the fifth floor, they make such a noise as to annoy the artists so much that they had to vacate the room. What can be done to stop the rumbling? Deadening the floor will be too expensive. A. There is less weight of wall on the ends of the floor joists of the fifth story than on those of the fourth, and consequently the vibration of the floor is greater. This vibration can be counteracted in a measure by diagonal braces in the story below, extending from the center of the fifth floor beams to the ends of those of the fourth story, provided that the uses of the latter story will permit it.

(13) T. E. asks: What size of boiler will it take to run a small engine, the cylinder of which has a 1 inch bore and 2 inches stroke? A. Make it 10 inches in diameter, 15 inches high.

(14) G. W. K. asks: How are turbine water wheels tested? A. The ordinary method is to measure the power exerted by means of a friction brake, and at the same time to note the amount of water used, either by actually meas-

uring it, or by observing the height of the discharge on a weir of known dimensions. Then the actual horse power developed, divided by the total horse power of the water that was used, represents the efficiency of the wheel.

(15) J. M. W. asks: 1. Does nearsightedness, the eyes being used properly and carefully, increase or diminish with age? A. It is apt to increase. 2. Do you know of any remedy? A. No.

(16) O. A. L. asks: Has light of itself any other color than white, or a homogeneous color? Or, in other words, are the different colors of flames caused by light shining upon the smoke which the burning materials produce? A. Rays of light have various colors, depending, according to the undulatory theory, upon the wave lengths of the vibrations producing the light. Why is it that silk is always twisted in an opposite direction from cotton or woolen thread? A. Because in silk the separate strands are twisted, both before doubling and after.

How can I raise a number to a three and six tenths power by a short method without using algebra? A. Multiply the logarithm of the number by 3 5/6, and find the number corresponding to the resulting logarithm.

(17) L. S. C. says: I wish to cover a long line of steam pipe, to prevent loss of heat by radiation. I have been advised to cover it with a wrapping of paper, then a wrapping of straw, say two inches thick, then another covering of paper, the whole to be covered with some kind of cloth to fasten it. Another party recommends boxing the pipe in and filling the box with ashes. Which plan is the better? A. Either of these methods will answer pretty well, the second being preferable on some accounts.

(18) H. S. says: In your issue of August 12 you refer to a catamaran which vanquished the New York yachts in a recent encounter. Can you give us any idea how and of what she was built, and her size, safety, etc.? A. The vessel referred to was something like a proa, a form of sailing craft that is noted for speed and safety. The boat proper is like the hull of a narrow canoe, and a canoe-shaped log is connected, by means of a light framework, to windward. The side to which this attachment is made is always the windward side, the sail being shifted from one end of the boat to the other, when it is desired to go about. See the first page of this issue.

(19) B. R. asks: When there is a steady downward pull, the weight being suspended by the end, and there being no jar, what is the strength of a rod of good malleable iron, compared with wrought iron, rods being of the same size? A. We presume you refer to what is called malleable cast iron. We have seen no record of very reliable experiments on its strength. Professor Rankine gives 48,000 lbs. per square inch, making the result doubtful. Good wrought iron has a tensile strength of from 55,000 to 60,000 lbs. per square inch.

(20) E. H. F. says: 1. I am going to build a canvas boat, and would like some suggestions as to how to proceed? A. The process is quite similar to wooden boat building, the frame being made in the same manner, and canvas being used for sheathing instead of wood. The bottom should be fitted with a light wooden platform. 2. I want the boat to be about 11 feet long. How wide and how deep should it be? A. If you want great carrying capacity, make the boat from 4 to 4 1/2 feet wide, and 2 feet deep.

(21) W. E. F. says: The new Independence bell placed in the old State House at Philadelphia is defective in tone. Many of the newspapers have endeavored to show why a bell, twice the size of the old one, cannot be heard so far. Will a bell of the same internal diameter give as high (or sharp) a note (all other things being equal) if its wall is 2 inches thick, as will one whose shell is 1 inch thick? A. The thick bell will make the most vibrations in a given time, other things being equal, and therefore give the higher note.

(22) D. K. says: A friend asserted that the pressure above the water in a steam boiler was not the same in all places; and he cited an instance where a number of steam gages had been put (in different places) on a large boiler, they showed a difference of 5 lbs. pressure. Was that due to a difference of pressure, or was it caused by currents of steam through the boiler? A. There is some difference in the pressure at different heights, not on account of steam currents, but because the pressure at any level is that due to the steam pressure increased by the weight of the water and steam above that level.

(23) E. H. L. says: Philosophers tell us that sound travels at a certain rate. But do some sounds travel faster than others? We were rifle shooting to-day at a distance of 500 yards from a canvas target. A ledge of rock stood 7 feet beyond the target. The sound made by the bullet in piercing the canvas was distinctly heard and recognized, as well as the sound of the bullet striking the rock 7 feet beyond. The precise time which elapsed between the two above-mentioned sounds striking the ears we cannot give, but it was far too long to be in proportion to the distance, difference of distance being only 7 feet. It appears to us that the sounds should almost blend; but at 500 yards distance, there was a lapse of time of at least 1 second. This was repeatedly noticed by different men with different rifles. A. This seems to be beyond philosophy, as stated; at least we cannot offer any explanation. It may be, however, that there are other elements that should be considered. We have heard the successive sounds that you speak of on several occasions, but were always able to account for them quite reasonably. If any of our readers can furnish any notes in relation to the matter, we will be glad to hear from them.

(24) W. H. asks: Would it make any difference in the speed of 2 rowboats 18 feet long, one having a straight cutwater and the other having a cutwater inclining 4 inches in 18, this being the height of the boats, other things being equal? A. We scarcely think there would be any appreciable difference.

(25) J. F. N. asks: How can I remove the scale from sheet steel? A. With an emery wheel.

(26) D. R. W. says: We are obliged to use water from a well for watering plants. It forms an incrustation upon the earth and the flower pots, which, we presume, is alkali. Can you recommend anything which we can put into the water to neutralize the alkali? A. It is probably a lime salt. Try the addition of a little clean lime water, allow to stand a short time undisturbed, then pour the water off from the sediment.

(27) H. H. S. says, in reply to G. M. F., who asked if plaster of Paris were suitable for porous cells: Some two years ago I made several cells of Daniell's battery, using plaster porous cups, and found them to work very successfully. These cells were about the cheapest I ever saw. A. If the plaster cells are porous, they will answer instead of porous clay cells.

(28) H. J. says: Some time ago I saw an article in your paper recommending coffee as a disinfectant. It would be very expensive, and I have for years been using coffee grounds after the coffee has been extracted. I dry them and keep them for use. I simply sprinkle them over a hot stove or shovel of coals in the sick room. They would be good for emigrant vessels or hospitals, and might be used to great advantage in the yellow fever districts at present.

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

H. S. S.—It contains no silver.—C. H. C.—It is decomposed mica.—C. P.—It is black oxide of manganese.—J. B. H.—It is carbonate of copper with shale.—H. W. S.—Both are sulphides of iron, No. 1 being pyrite, No. 2 marcasite.

COMMUNICATIONS RECEIVED.

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

On Aerostation. By J. J. R.
On Celestial Dynamics. By J. W. H.
On Mental Telegraphy. By J. L. M.
On Trisecting an Angle. By P. H. F.
Also inquiries and answers from the following:
F. P.—H. H. L.—V. R. D.—W. C. K.—N. B. P.—W. L.—W. T.—R. K.—J. C. W.

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.

Hundreds of inquiries analogous to the following are sent: "Who sells the best dies and taps for screw-cutting work? Who makes the best gas apparatus for domestic use? Who sells Centennial bronze medals? Who makes the improved zinc white, described on p. 328, vol. 35? Who makes the best incubators? Who sells the best ice machine?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

October 3, 1876.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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9,511 to 9,534.—CARPETS.—O. Heineke, New Utrecht, N. Y.	
9,535.—CANDY BOX.—J. H. Rirner, Philadelphia, Pa.	
9,536 to 9,551.—CARPETS.—H. Horan, East Orange, N. J.	
9,552 to 9,557.—CARPETS.—E. J. Ney, Dracut, Mass.	
9,558 to 9,560.—CARPET.—H. Nordmann, New York city.	
9,561 and 9,562.—CARPETS.—G. W. Piggott, N. Y. city.	
9,563 to 9,566.—CARPETS.—J. H. Smith, Enfield, Conn.	
9,567 to 9,571.—CARPETS.—W. H. Smith, Enfield, Conn.	
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Vol. XXXV.—No. 20.
[NEW SERIES.]

NEW YORK, NOVEMBER 11, 1876.

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GLASS MAKING AT THE CENTENNIAL EXPOSITION.

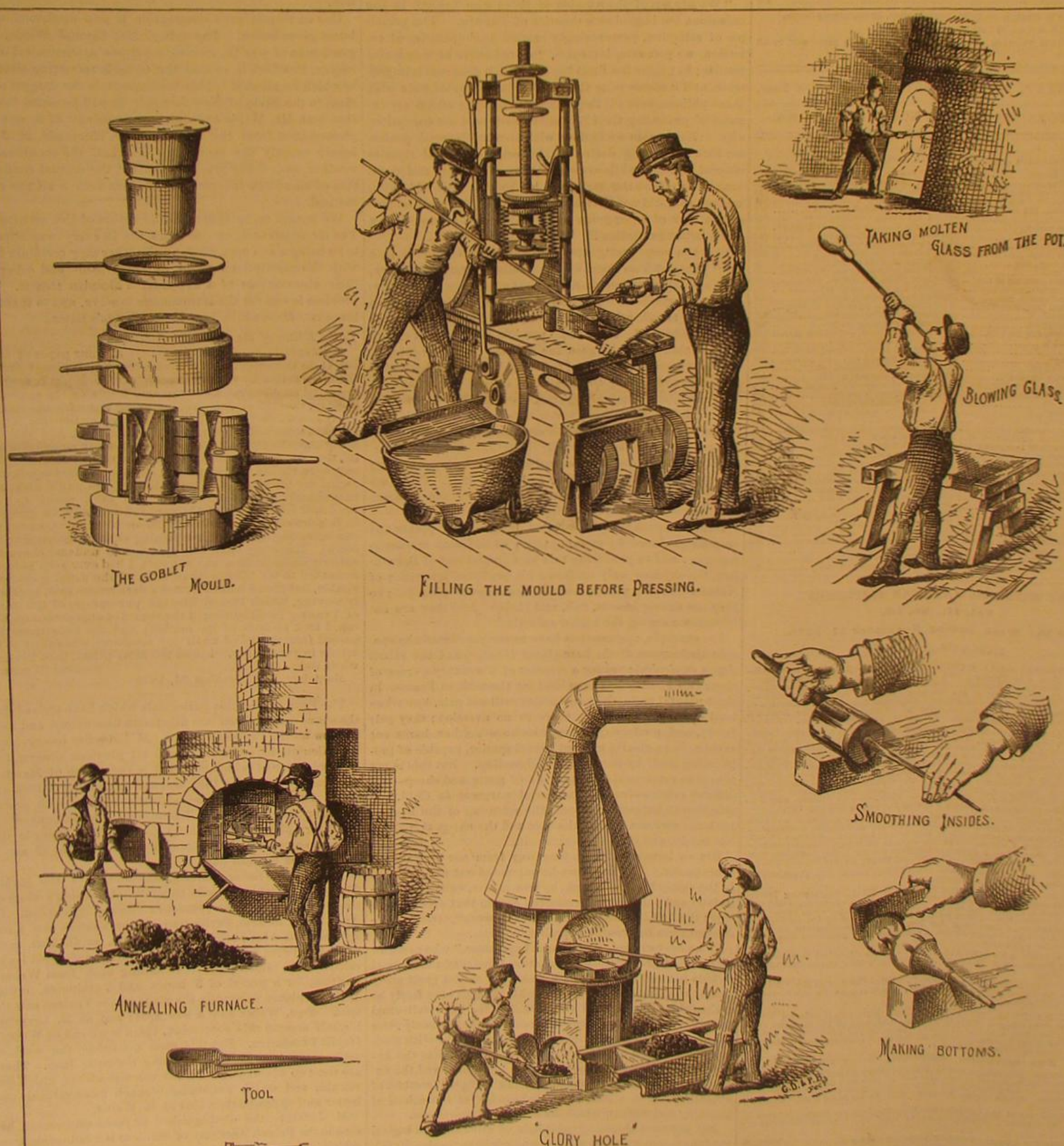
There is no portion of the Centennial Exposition more generally interesting, or which at all times attracts greater crowds of people, than the glass factory. This is located in a separate building, in rear of the huge shed wherein are exhibited the steam sawing machines, and there, for the first time in the history of any world's fair, the visitor may witness the entire glass-making process. Two weeks before the Exposition opened its gates to the public, the fires under the great cluster of pots were lighted, and since then, some seven tons of materials have weekly been melted and con-

verted into tumblers, and goblets, and vases, and the hundreds of minor articles designed as *souvenirs* of the Centennial.

The operation of glass making begins with charging the pots, which are huge crucibles of clay arranged around the central fire of a huge furnace, the lofty stack of which, always pouring forth smoke, is a prominent object in any distant view of the grounds. In these pots the raw materials, sand, pearlash, lead, soda ash, lime, nitrate of soda, various oxides, etc., are placed, previously being thoroughly ground and mingled with broken glass. Each pot holds about 1,600

lbs. of ingredients, and but half of the total number of pots are worked at a time. A part of the charge is first inserted; then as this melts more is added, and thus the receptacles become gradually filled with melted "metal." The fire is now urged, and the workmen constantly thrust their long iron bars into the viscid dazzling mass, withdraw a huge drop or two at a time, and examine it, until at last the bubbles, which at first are thickly scattered through it, become fewer and fewer; the scum which forms on the surface is ladled off, the heat is carried to the highest degree

Continued on page 308.



GLASS MAKING AT THE
CENTENNIAL EXHIBITION.

M. Janssen, the distinguished physical astronomer, has sent to the French Academy of Sciences the following note which offers excellent suggestions to observers. The roundness of an observed body, he says, on the sun's face is not a specific characteristic of an intra-Mercurial planet; neither does its disappearance after five or six hours incontrovertibly prove a planetary transit. There exist, however, features determined from the constitution of the photosphere which allow, even during the brief instants of a fugitive observation, of deciding whether the phenomenon seen is

solar or extra-solar. The sun's surface is covered with granulations, which are called various names, but which are perfectly familiar to any practised observer. These become modified near the sun spots, and the latter (independently of the penumbra, which rarely is absent, especially about round spots) are surrounded with circular facule which almost invariably throw out appendages. A body in motion, interposed between the eye and the solar surface, should produce a succession of eclipses of the granulations, covering those toward which it progresses, and uncovering others behind it. This phenomenon of emersion and immersion is the most decisive test during a rapid observation. It requires, it is true, a good instrument of ample enlarging power; but observations made with small instruments are in any case doubtful, as they cannot include all the true characteristics of the phenomenon.

Photography nowadays gives us such perfect solar images that it may best be used in work requiring great precision. The photograph of a transit, if made with a proper instrument, carries with it the stamp of authenticity, and is better than the most perfect observation of the ablest astronomer. In order to search for Vulcan by photography, a succession of pictures of the sun will have to be taken so rapidly that no time, sufficient for a transit to take place, will elapse between any two. A revolving apparatus using dry plates and working automatically, so as to take a photograph once an hour, would answer all requirements best, especially as the astronomer, by using dry plates, can afterwards develop his images at his leisure, or need not concern himself with photographic manipulations at all. A certain number of such instruments, says M. Janssen, distributed systematically over the globe and kept going for a few years, would explore the solar regions so thoroughly as to settle all question as to whether an intra-Mercurial planet does or does not exist.

THE CENTENNIAL AWARDS.

Viewing its work as a whole, the Centennial Commission has done wonders, it has made the Exposition a grand success, it deserves the hearty thanks of the people, and will get them. But its action in respect to the awards will, we fear, give considerable dissatisfaction.

It was decided to make supplementary awards, and there upon a board of judges of appeal was constituted. Had this board proceeded to review cases where injustice and oversight was charged, and to issue favorable reports when the facts warranted, signed by its particular members, all would be well; but probably incited by exhibitors who would not abate their demands one jot, and who wanted just exactly as valuable a report as their competitors had received in the first instance, and nothing else, the Commission concluded to render all reports equal by erasing the names of all the judges on all the reports, and substituting therefor the signatures of Director General Goshorn and Secretary Campbell.

The action, we learn, has been taken in the face of the opposition of General Walker, the Chief of the Bureau of Awards, and of prominent members of the Commission.

THE RETURN OF THE BRITISH ARCTIC EXPEDITION.

The British arctic expedition under Captain Nares, comprising the steamers Alert and Discovery, has returned, the Alert having arrived at Valentia, Newfoundland, on October 27. The ships left England on May 30, 1875, and entered the ice off Cape Sable, on July 29. After a severe struggle, the north side of Lady Franklin Bay was reached, and here the Discovery was left in winter quarters. The Alert pushed on up to latitude 82° 27', and there wintered. At this point the sun was invisible for 142 days, and the lowest temperature ever recorded was experienced. The mercury fell to 59° below zero, and remained so for a fortnight, and at one period reached 104° below zero. Sledge parties were fitted out, one of which traveled 220 miles to the eastward, and the other went to the north, proceeding on land up to 83° 07', and thence on the ice to 83° 21'. Further on, nothing but ice could be seen, which was so rugged that scarcely a mile of advance could be accomplished daily. The floes in some places measured 150 feet in thickness. Four men died from the effects of the cold. Finally, becoming convinced that it was impossible to get any nearer to the pole, and seeing that his men were succumbing under the hardships, while the Alert herself had been much damaged by the ice, Captain Nares started homeward, leaving Smith Sound on September 9 last.

This expedition, it will be remembered, was fitted out with every aid to polar exploration which Science could devise or the experience of the oldest arctic explorers could suggest. That it has failed to reach the pole is proof of the enormous difficulties to be overcome in that undertaking, rather than of any inadequacy to the task of those who attempted it. Indeed, we may believe that, after latitude 82° is reached, the obstacles augment in some compound ratio. The results which have been obtained are, however, of considerable importance. Captain Nares has reached the highest northern point ever attained, latitude 83° 21'. The Austrian expedition, which sailed, in 1872, toward Spitzbergen, only reached Cape Fligely in 82° 5', and sighted Cape Vienna in 83°. It is remarkable, however, that the Polar, ill equipped as she was, reached 82° 16', and wintered in 81° 38', while Hall, with a sledging party, pushed onward to 82° 30'. Captain Nares has, therefore, advanced 51 geographical miles further north than the American explorer, and has approached within 400 miles of the pole.

The details of the other accomplishments of the expedition which have reached us are very meager, but indicate that Captain Nares' forthcoming report will be of consider-

able value. President Land, usually marked on arctic maps, has no existence. Lady Franklin's Strait is really a bay; and from the fact that travel was conducted on the ice to the highest point reached, it would seem that no open polar sea was encountered. The northernmost point seen in Greenland, was in latitude 82° 57'. Excellent coal was found near the place where the Discovery wintered, and a number of valuable scientific collections and observations were made.

The Pandora is still in the ice, and was met by the Alert on October 16 (where, not stated), when she signaled "all well."

THE NEW YORK AQUARIUM.

The new aquarium at the corner of Broadway and Thirty-fifth street promises to be a positive and genuine addition to the city's resources for instructive entertainment. It is a pity it could not have been placed, as first proposed, in Central Park, and made a part of the valuable zoological exhibition already so popular there; but as that was impossible, we are thankful that Mr. Coup has had the courage to undertake it as a private venture. Unless we greatly misjudge the interest which most intelligent people take in such things, the enterprise cannot fail to command its full meed of recognition and reward.

At present, however, the aquarium labors under serious disadvantages as an exhibition. The water in the tanks is still almost turbid with decomposing vegetable and animal matter, making it difficult to see the objects exhibited, and even more difficult to keep them alive and well; while the work of stocking has been seriously hindered by the bursting of tanks and the death of many rare and valuable fish and aquatic animals. Nearly all the first supplies, including two white whales, were lost before the tanks were in proper working order; and many objects which might otherwise have been saved were killed in consequence of the absorption by the water of poisonous vapors from the freshly painted and varnished interior of the main hall.

All these obstacles and mishaps, it is to be hoped, will soon be corrected and overcome; the water will be freed of organic matter by aeration; new objects of interest will be added, and in a little while we may expect to see an exhibition of aquatic life such as will compare favorably with those which have proved so popular and instructive abroad.

Already the collection contains representatives of many of our principal salt and fresh water fishes, with a few that are rare and curious, besides turtles, alligators, seals, a young whale, and a considerable number of the lower forms of marine life. In capacity the building compares favorably with the more important aquaria abroad: not so large as those of Manchester and Brighton, but fully equal in tankage to many of the most useful and successful. The main tank, which has a front of 65 feet, is the second in size, it is said, in the world. Here, at present, are numerous dog fish, a regular shark of considerable size, a gigantic sturgeon, several large sea turtles, and a number of skates and rays. In the center of the pavilion is a raised circular tank 30 feet in diameter, now occupied with a white whale calf from the Gulf of St. Lawrence. In front is a depressed pool of equal dimensions, where three active and clever seals have already made themselves the pets of numerous visitors. Back of the whale tank, and occupying the larger part of the western end of the pavilion, are the sea lions' pools, surrounded by an attractive rockery, and spanned by a rustic bridge from which a good view is to be had of the entire exhibition hall.

The northern side is devoted to a row of large tanks, lined with rockwork and tenanted at present with numerous representatives of our principal lake, river, and sea fish, besides crabs, lobsters, anemones, and the like. Four of these tanks present a crystal frontage of 8 feet by 10 feet each; and a dozen smaller ones have 4 by 5 feet fronts. On the southern side are twenty-five or thirty table tanks, glazed on all sides, for the exhibition of the smaller fish, crustaceans, etc.; a large tank for trout and allied species; and—one of the most valuable features of the aquarium—Mr. Mather's tank for fish hatching, now occupied in part by an interesting lot of California salmon eggs in process of development.

The arrangements for securing a constant circulation of water through the tanks, for aerating the water when it enters the tanks, and again when it is on its return course to the main reservoirs, and for hastening the oxidation of the organic matter originally in the water and constantly being added to it by its inhabitants, are ingenious and satisfactory. By these means only the loss by evaporation and leakage has to be replaced, the original supply of water being used over and over again, as in Nature, while undergoing a perpetual process of purification.

Specially to be commended are the educational features of this new enterprise, particularly those designed to assist practical students of marine life in the prosecution of their researches. As an adjunct to the aquarium, it is proposed to have a free scientific reading room, and a laboratory, provided with experimental tanks, dissecting tables, microscopes, and other appliances for the critical study of aquatic life and the anatomy of aquatic forms. This department, for which pleasant rooms have been provided over the main entrance, is under the direction of Professor W. S. Ward at whose suggestion it was established. It is proposed to admit to its privileges all such teachers and students as may desire to avail themselves of the opportunity thus offered for the practical pursuit of zoological studies.

The general aspect of the main pavilion, with its rustic work, and foliage is quite pleasing, and we have no doubt but that it will soon become a place of great resort. Its popularity and its profitableness as well, we think, would be in-

creased by a large reduction of the admission fee; but that is a matter which the proprietors will have to demonstrate for themselves. It is to be feared, too, that an unfavorable impression of its value will be gained by many who visit it just now, for the collection is comparatively meager; and though containing much that is curious and interesting, it falls so far short of what one might expect from the bombastic advertisement that it is really disappointing, for the money. As a beginning, however, considering the difficulties to be overcome in starting an enterprise so largely experimental in character, it is worthy of every encouragement.

DETOXICATED TOBACCO.

A correspondent, referring to our recent article "A Cigar Scientifically Dissected," asks whether there be not some method whereby tobacco can be rendered innocuous and yet have its agreeable aroma preserved. The fact that numerous attempts in this direction have been made, and yet there is no substitute for tobacco and no de-nicotinized tobacco in general use, is in itself a sufficient answer to the question. It is the combination of poisons which we enumerated which produce the agreeable taste and smell, and to remove any of the ingredients seems simply to render the tobacco unpalatable.

Upon many persons coffee exercises a very deleterious influence; but they can, and often do, drink a chicory infusion, which tastes very like that of the Arabian berry, though totally destitute of all the aroma of coffee. Similarly it is possible that there may be some vegetable which is sufficiently near in savor to tobacco to render it valuable as a substitute or as an adulterant for the genuine leaf; and it might be well for botanists and chemists to undertake researches with a view to discovering the same. Meanwhile the most successful efforts to render tobacco less hurtful have been those involving mechanical means. The Turkish nargileh or water pipe, in which the smoke is drawn through water, is probably the least harmful method of smoking practised, a fact proved by the thick dark scum of oil which appears on the water after use. A nargileh is easily made out of a wide-mouthed bottle. The tube attached to the pipe bowl is led down beneath the surface of the water which half fills the vessel, and the smoke is withdrawn through another tube which enters the empty space above the water. Numerous pipes have been patented in which the smoke is filtered through cotton or sponge, or led into a little chamber where the oil is deposited, and thence withdrawn. Attempts have been made to treat the smoke chemically during its passage through the filter. M. Ferrier soaks the cotton in a solution of tannin, and dries it in the air. The tannin, he claims, retains the nicotine in chemical combination. French chemists who have tested this plan are widely at variance. Cahours confirms Ferrier's experimental results, and says that the nicotine is wholly removed. Barral objects that nicotine is not capable of uniting with tannin, and that the latter substance is not less injurious than nicotine. We do not find many records of investigation in this branch of the subject, and researches here also might be valuable.

After the water pipe, the safest way of using tobacco is to smoke a mild quality in a pipe made of meerschaum, charcoal, or porous unglazed clay. The pipe bowl then absorbs the oils to a considerable extent, as the coloring of pure white meerschaum plainly shows; and the impurities should be frequently burned out, or new bowls substituted, in order to keep the absorbent qualities unimpaired. The most hurtful method of smoking is the Cuban paper cigarette, where the deleterious fumes of burning paper are added to those of the exceedingly strong tobacco enveloped.

It may be justly considered that in most cases the use of tobacco is an abuse; but it is equally true that devotees of the weed have lived to the most advanced ages, and that thousands habitually smoke without being able to appreciate any deleterious results. There is no standard, therefore, whereby the evil effects of the habit can be gaged for everybody. Dr. Smith, some years ago, read a paper before the British Association, in which he adduced experiments showing that, while tobacco smoking causes a large increase in the rate of pulsation of some persons, in others no increase whatever occurs; and hence he demonstrated a marked diversity in the mode of action of tobacco on different systems. A typical experiment cited is that of a person who began smoking a pipe with the pulse at 74.5 beats a minute. In nineteen minutes the rate rose to 110, then to 112. Finally, at the end of half an hour after the commencement of the smoking, it was at 88.9. For more than two hours it remained above the natural average of frequency and force. In a person of full habit, such acceleration of the heart leads to apoplexy. It is clear that, if in one individual tobacco is able to produce conditions favorable to a disease which may kill at any moment, and in another is practically inert, it is useless to argue either that it is generally highly dangerous, or, on the other hand, destitute of dangerous effects. As we said in our previous article, the ingredients of tobacco are separately poisonous; the probabilities are that they are collectively so in every case. But some systems are strong enough to withstand their effects either wholly or in part; and for every individual to discover whether his particular constitution belongs to this last class, involves in all cases a course of experiment in learning to smoke which is universally admitted to be one of the most unnatural, nauseous, and disagreeable experiences of the human existence.

EQUAL parts of tin and copper form a white speculum metal as hard as steel.

THERMOSTATIC APPARATUS FOR CONTROLLING VALVES.

We illustrate herewith a novel device designed for automatically operating and controlling valves in steam or other pipes, which has for its object the retaining at a stated temperature either water or air. A represents a boiler of water, to be heated by the introduction therein of live steam, and an even temperature of the same maintained. B is the steam pipe, through which the steam is conducted. C is the inlet and D the exit pipe, by means of which water is introduced and withdrawn from the boiler or tank. These parts may be of any ordinary form of construction, and therefore call for no detailed description. E is a hollow stand. G is a hollow disk made from brass; and extending upwardly from its center is a brass tube, H. This disk and tube are made of as thin sheet metal as is possible, so as to be very sensitive to the variations in temperature. At the upper end of the tube, H, it is reduced to a less diameter, as shown at I, so as to confine the action of expansion and contraction of the fluid, with which the disk and tube may be filled, to a small column, thus increasing its sensibility and rapidity of action. The upper and reduced end, I, of the tube reaches just above the water line, as shown. Into this reduced tube a piston, a, is inserted and attached to a connecting rod, b, which extends upwardly through the upper frame of the boiler to the valve, c, in the steam pipe, B, to which it is attached. It is provided with a check nut, d, which may be adjusted to control the extent of motion. The disk, G, and tubes, H and I, are completely filled with an expansible fluid before insertion in the supporting frame in the boiler. A light spiral spring, f, is attached to the connecting rod operating the valve, c, and operates to force down the plunger, a, as the fluid in the tube, I, contracts.

The boiler being filled with cold water, the expansible fluid in the disk and tube, H, is contracted so as to drop the plunger, a, to the full extent of its downward motion, opening wide the valve, c. Live steam then being admitted to pipe, B, it freely passes through the open valve and enters the water in the boiler, heating the same to the degree of temperature desired. This heating of the water conveys its action to the fluid and expands it in the disk and tube, forcing the plunger or piston, a, upward, thus closing the valve, c, and shutting off the supply of steam, or so much of it as may be necessary. As the temperature of the water falls, the fluid in the disk and tube contracts, and the piston drops with it, again opening the valve and admitting a new supply of steam.

The operation of the plunger, d, may be so adjusted that it will rise and fall at a certain degree of heat, or close the valve and open the same at specified degrees of heat, which points may be indicated upon an indicator located above the apparatus and connected with the lever operating the valve, and actuated thereby. It is evident that this indicator will, as the valve rises or falls, indicate the changes and present temperature of the water in the boiler.

This apparatus was patented March 7, 1876, by Mr. H. R. Randall, of Brooklyn, N. Y.

A NEW FLOUR BOLT.

We illustrate herewith a novel apparatus in which an air blast removes the fuzz and fine clammy dust from flour while the material is undergoing separation from bran and middlings in a bolt or reel. The short inlet pipes, b, connect with long perforated distributing tubes, which admit air below the bolt, a. The air is drawn by the fans through the chamber, e, and exhausts at d. g is the spout to the dust room, and at h are slides for regulating the draft.

This device was patented through the Scientific American Patent Agency, September 12, 1876, by Mr. John P. Agler, of Avoca, Iowa.

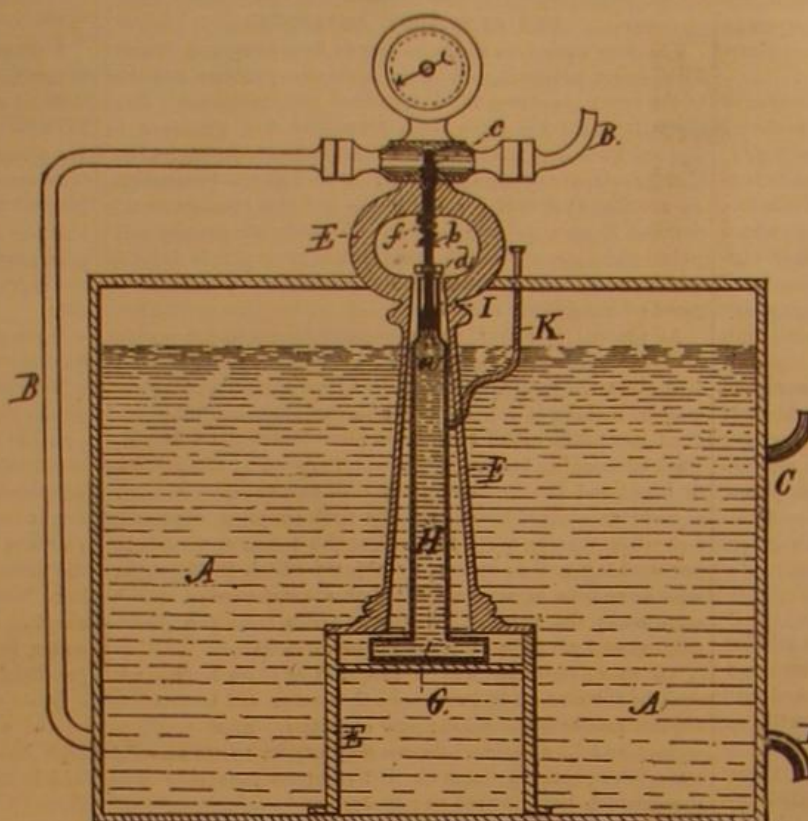
Purifying Calcareous Water.

A company has recently been formed in England to furnish potable water to the large district situated to the northwest of London. Water in that locality, although abundant, is so extremely hard, owing to its filtration through the lime formation, that it is scarcely utilizable. The object of the company is to remove the calcareous matter, and to this end extensive buildings and reservoirs have been constructed. The water is pumped up from wells directly under the works, and is purified in the following manner: Quicklime is slaked in a circular basin and mixed with water in other receptacles, so as to form a milk. This, by its weight, travels into the main reservoirs, which contains 2,000,000 gallons of water, and is allowed to act on the water for about five hours. At the end of this time the bicarbonate of lime held in solution is precipitated, and the water is pumped off into a distributing

reservoir. The lime is frequently removed and sold for agricultural use.

The Machinery Exhibit.

A mechanic, alluding in the *London Times* to our mechanical exhibit, acknowledges that the display of machinery at the Philadelphia Exhibition has never been equaled, either for quantity, or for quality, or for fitness. The grand effect which it produces, adds the writer, is no mere result of repetition according to well known forms of construction, but is due to abounding novelty, originality, and progress. This department of the Exhibition has a strongly marked

**THERMOSTATIC APPARATUS FOR CONTROLLING VALVES.**

American character, and can hardly be regarded as an international competition. Other civilized countries, it is true, take part therein, and Great Britain especially, but the aggregate does not equal one fourth of the articles exhibited from the United States. There is also marked evidence of patriotic spirit in the prodigious efforts made by individual citizens and firms to sustain worthily the mechanical reputation of the country. The extent, the money value, the excellence and originality of the objects displayed by them impress a stranger immensely; and however much he may have seen of former international exhibitions on the grand scale, these impressions survive.

The Sonorous Qualities of Metals.

M. Decharme has recently concluded a series of experiments to determine the sonorous capabilities of different metals. Cylindrical rods, 7-8 inches in length and 0.39 inch in diameter, were suspended by threads or rested on cork

0.3, tin a little less than 1, zinc 1, cast iron a little less than 2, copper about 5, wrought iron 12, brass 14, bronze 24, steel 45. The author notes the fact that a steel rod, when supported on the sides of cork prisms, gives a sound which lasts but 25 seconds, or but little over half the period as when the steel is suspended. Brass, on the contrary, sounds from 20 to 25 seconds when on the corks, instead of 24, as when suspended by the thread.

Painless Extinction of Animal Life.

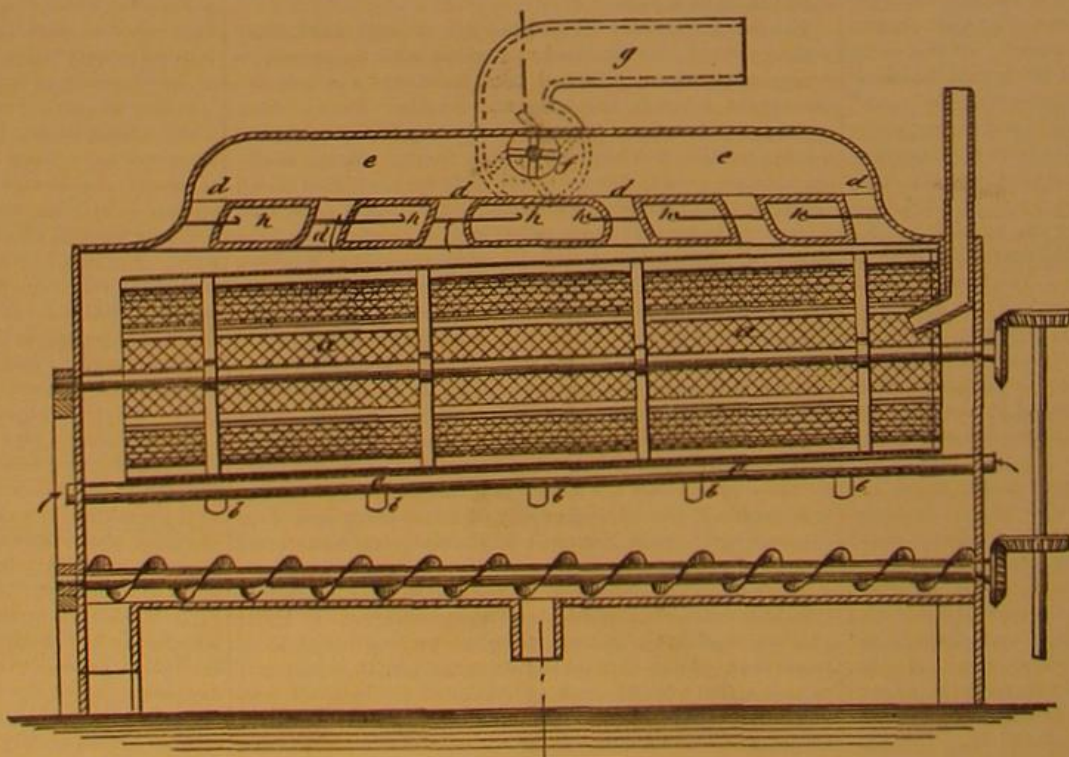
"The latest experimental researches which I have conducted on lower living animals," says Dr. B. W. Richardson, "have had for their object the discovery of a ready, cheap, and innocuous method for killing without pain those animals which are destined, as yet, for the food of man. If the labor of the physiologist be allowed to progress, the day will soon arrive when the slaughter of animals for food will become unnecessary, since he will be able to so transmute the vegetable world as to produce the most perfect and delicious foods for all the purposes of life without calling upon the lower animal world to perform the intermediate chemical changes. But until this time arrives, animals will have to be slaughtered, and my research has been directed to make a process, which at present is barbarous and painful, painless in the most perfect degree. For this purpose the various modes of rapid destruction of life—by powerful electrical discharges, by rapid division of the *medulla oblongata*, and by the inhalation of various narcotic vapors—have been carried out. The experiments, which have been exceedingly numerous, have led me to the conclusion that the most perfect of the painless methods of killing is by the inhalation of carbonic oxide gas. So rapid and complete is the action of this gas that I may say physiological science has done her part, as far as it need be done, for making the painless killing of every animal a certain and ready accomplishment, an accomplishment also so simple that the animal going to its fate has merely to be passed through the lethal chamber, in order to be brought, in senseless sleep, into the hands of the slaughterer. The application of teaching and the putting into practice this humane process lies now with the world outside Science: but to insure its acceptance, all the force of selfishness, of prejudice, and of practical apathy for the sufferings of the animal creation, has to be overcome. There is a great deal of talk and a great deal of sentiment abroad on the question of the sufferings of the lower animal kingdom; but when an attempt is made to relieve those sufferings by the invention of methods for operating surgically, without the infliction of pain, or for painless killing, the true and vital sympathy, which one would expect in support of such practical and humane efforts until they are made perfect and universal, can scarcely be said to be found at all. With the exception of a few, not a dozen altogether, of really humane ladies and gentlemen, I have found no one, out of the ranks of Science, in the least interested in the saving of sufferings to which I am now directing attention. The man of science stands and wonders at the strangeness of the psychological problem before him; and, in spite of himself, is forced to the conclusion that, practically, the noise that is made at him in the name of humanity is, after all, sounding brass and tinkling cymbal."—*Nature*.

The Cost of Big Guns.

The trials of the 81-ton gun which have recently taken place in England are reported as being conveniently satisfactory to the artillerymen; but it may be doubted whether those who are footing the bills, the tax payers, will share in the officially expressed gratification. At every discharge of this monster weapon, over 300 lbs. of powder are exploded at a cost of from \$125 to \$150. To this must be added the expense of shell and fuses. Then the gun itself, originally estimated to cost \$40,000, has actually necessitated an expenditure of some \$125,000, besides the construction of a railway at Woolwich, a barge for its transportation, and several huge cranes. Moreover the firing of the gun at Shoeburyness has had the effect of blowing down or at least seriously shattering the huts and cottages of that military settlement, so that it will nearly all have to be rebuilt at government

expense. Meanwhile, on this side of the Atlantic, we complacently view these rather costly proceedings, profit by the results of the experiments, and congratulate ourselves that we are not paying for them.

THE secret of making the hammered bronze Chinese gongs and Turkish cymbals consists in forging the bronze into shape while hot.

**ALGER'S FLOUR BOLT.**

prisms. Each was struck by a piece of wood covered with rubber. As regards number of vibrations, lead was found to yield the lowest, or in the ratio of 690 to the maximum of 2,703 for aluminum. The intermediate results are: For gold 976, silver 1,034, tin 1,161, brass 1,303, bronze 1,381, zinc 1,422, copper 1,462, cast iron 1,843, wrought iron 2,192, and steel, 2,322. As regards duration of sound, the following results were obtained in seconds of time and fractions: lead

COMPENSATING STEAM GENERATING APPARATUS.

Mr. John Cowan, in the apparatus illustrated herewith, has devised a certainly novel and ingenious and, according to the practical results which he reports to us, an important method of economizing in the use of steam. It opens the possibility of getting steam for nothing, and even making a small profit—a condition of affairs somewhat difficult to realize. Mr. Cowan's plan is a genuine one, however, and because it is so it is unlikely to carry conviction speedily with it; but as we said before, he has the figures, and, what is better, can point to its successful practice in this country in at least one good instance.

The gist of the system may be explained in few words. In burning limestone in the kiln to make lime, an enormous amount of heat is wasted. Still the amount for which the lime will sell pays a profit despite the waste. Now there is no reason why this lost heat should not be utilized, Mr. Cowan argues, and he further believes that the limestone in burning adds to the heat; whereupon he builds his steam boiler over and about a furnace suitable for the calcining of lime, and makes steam, which costs nothing, with the waste heat which costs nothing.

Sometime ago we explained the hot water apparatus which had been constructed on this principle for heating greenhouses and buildings. At the present time the inventor goes a step further, and has contrived an application to steam boilers to supply motors with steam, and thus he proposes a means whereby power can be obtained at practically no cost.

The new apparatus is illustrated in our engraving. A is the furnace, B the boiler, and C a feed water heater. At D is the firebrick lining, and at E and F the air space or sand backing and masonry. H is the drawhole for removing the lime, and K is the flue boiler. The use of the remainder of the apparatus is evident in the engraving. Layers of limestone and coal (anthracite is the best) are placed in the furnace, and the whole fired. The lime remains in lumps, while the coal goes to impalpable ashes and practically disappears. During the night, when fires should be banked (a process of course out of the question while the lime is being burned), the escape of steam is provided for, and an automatic apparatus preserves a constant water level in the boiler. The evaporation is thus kept going on a half rate, or thereabouts, during the night; and in closing the escape valve and opening connection with the engines, work can be begun in a few minutes. The labor required is said to be no greater than in firing with an ordinary boiler, and the furnace or kiln can be made any size. In fact, with the exception of the extra depth and the necessity of an aperture for removing the lime, the furnace is not materially different from that of any steam generator.

The inventor submits testimonials showing that in England a six horse engine was used, for driving a mortar mill and other machinery, at a cost for fuel of only from \$1.25 to \$3.75 per week. He also states that a 15 horse power engine, running under a minimum pressure of 45 lbs., has been operated at an average weekly cost for fuel of \$4.52. It is in heating greenhouses that cases have occurred where the system has yielded a clear profit over all expenses. At the gardens of Stackpole Court, the property of the Earl of Cawdor, in England, the cost of heating the greenhouses was \$487 yearly, with nothing on the credit side but dust and ashes. When the limekiln was used the cost was \$425.16, and as the produce of lime sold for \$477.25, it will be seen that the new apparatus thus cleared its cost and left a balance of over \$50, which, added to the cost under the old system, left a profit of some \$540.

In this country, where limestone and other carbonates of lime are abundant, and can almost always be obtained for the mere cost of quarrying and hauling; and where anthracite coal abounds, it is believed that the process can be car-

ried on even more economically than is indicated by the foregoing figures. In addition to its application to steam boilers and to greenhouse heating, the invention has likewise been adapted for gas manufacture, and is said to be very successfully employed for this purpose. In fine, the uses to which the apparatus may be put embody all those where economy of working is the great desideratum, such as for pumping, driving stone-crushing machinery, mortar mills, etc., and for contractors' use, in the construction of railways, docks, and other works where large quantities of lime are required for building tunnels, bridges, retaining walls, etc.; also for draining mines and quarries, irrigation and sewage

repaired without disturbing the connection between said head and the bottle.

The novel feature is an extension collar, H, upon which is formed a screw thread to screw upon the neck of the bottle, and another a screw thread to screw into the inner surface of the base, A, of the head. Upon the collar, H, is formed a groove to receive a packing ring, which is pressed against a shoulder of the base, A, to prevent any leakage. Around the opening through the collar is formed a recess to receive the upper end of the glass pipe, and a shoulder to receive the packing that prevents leakage through the joint between the collar and bottle. With this construction the head can be unscrewed from the collar, H, and detached, and the valve repacked or repaired without disturbing the connection between the collar, H, and the bottle, and without disturbing the position of the glass pipe.

The Carpet-Eating Bug.

For some time past the housekeepers in Schenectady and in Utica, N. Y., have suffered from the ravages of a peculiar bug, which, though wholly unlike the carpet moth, is nevertheless fully as persistent a destroyer of carpets. It infests the edges where the fabric is nailed to the floor, and eats large holes. Occasionally entering a crevice between the floor planks, it follows the crack, eating as it goes, cutting the carpet as cleanly as if shears had been used to divide it. The depredations of the insect have lately increased, and the pest seems to be spreading to cities adjacent to those above mentioned.

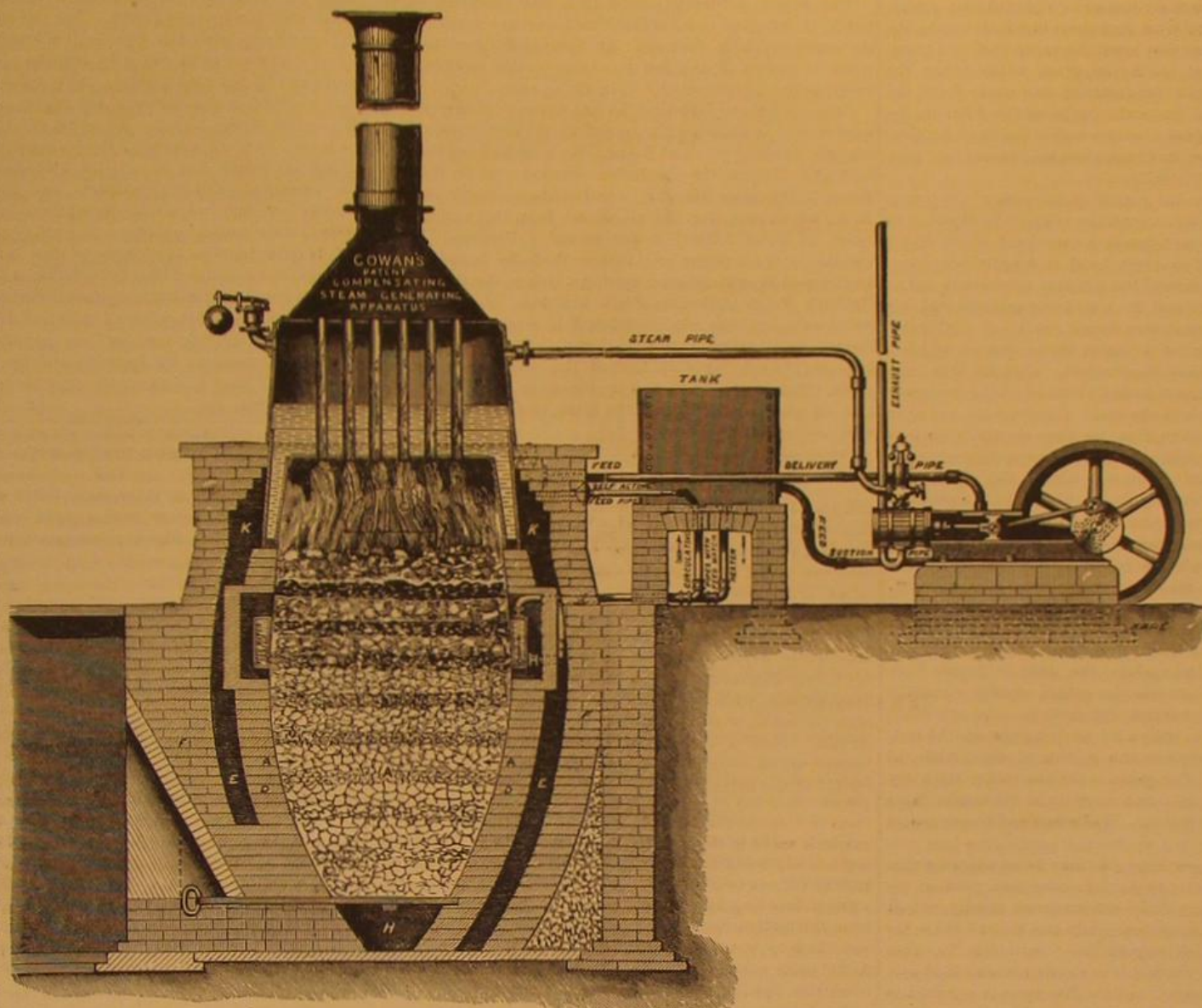
In appearance the insect is ovate, about $\frac{1}{8}$ inch in length, and is thickly clothed with numerous short bristles like hairs, terminating in a bunch forming a tail. It is exceedingly active in its movements. Professor Lintner, of Schenectady, who recently examined the bug, pronounced it the larval stage of a beetle, and in all probability a member of the very destructive family of *dermestidae*, and belonging to the genus *anthrenus*. Quite lately he succeeded in obtaining the first example of a perfect insect, a very minute beetle, approximately $\frac{1}{16}$ inch in length, but beautifully marked in red, white, and brown. This was submitted to Dr. Leconte, of Philadelphia, and that distinguished authority confirmed Professor Lintner, and determined the bug to be the *anthrenus scrophularia*, a very common destructive insect in Europe, but never hitherto detected in the United States. It is allied to the *a. varius* or museum pest, which destroys stuffed animals and similar objects in museums. No preventive measures against the insect have yet been found.

The Centennial Main Building To Remain.

The Fairmount Park Commission has yielded to the popular demand, and the Main Exhibition Building is to remain, to be used as a grand bazar and industrial fair: with the proviso, however, that the structure is to be removed after two years' notice shall have been given. The charge for admission is restricted to 25 cents for five days of the week, and 10 cents on Saturday; and when the income it yields is sufficient to pay expenses and interest on the investment, the admission fee is to be still further reduced, so that the public may enjoy the exhibition at the lowest possible charge for entrance.

The British Government has recently presented Philadelphia with the handsome buildings now occupied by the British Commission. What with the Main Building, Memorial Hall, Horticultural Hall, and probably Machinery Hall, together with the British edifices, the statues, etc., it appears that a considerable portion of the Centennial structures will be left, affording all the facilities for a very large permanent display.

The Exposition will close on November 10; but visitors will continue to be admitted as usual after that date, in order to provide necessary funds to defray expenses of police maintenance, etc.



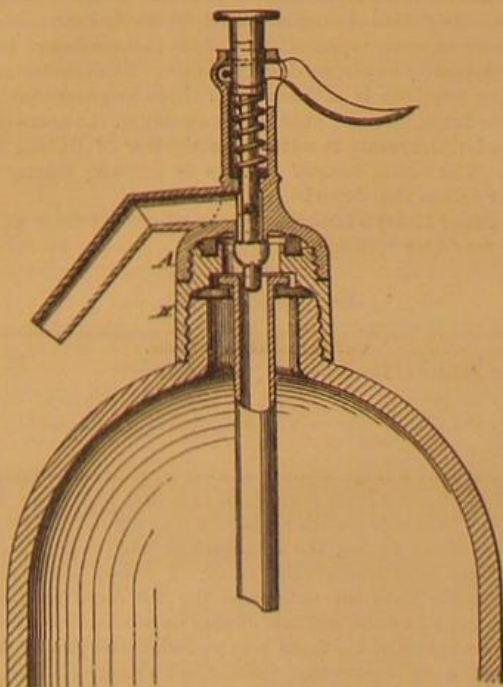
COWAN'S COMPENSATING STEAM-GENERATING APPARATUS.

works, for use in chemical works and breweries, and where evaporation is carried out on a large scale.

Mr. Cowan, the inventor, is now in this country, and may be addressed at the Astor House, New York city. He is desirous of disposing of all his American patents relating to the device. Through the kindness of Matthew Baird, Esq., of Derby Road, Philadelphia, Pa., an apparatus of this kind can be seen in successful use.

IMPROVED SIPHON HEAD FOR BOTTLES, ETC.

Mr. Joseph W. Stillwell, of Peekskill, N. Y., has patented,



through the Scientific American Patent Agency, September 26, 1876, an improved siphon head for mineral water bottles, etc., illustrated herewith, the object of which is to enable the valve of the head to be removed and repacked or

Continued from first page.

for some 20 hours, and finally the bubbles disappear, and the now fluid mass becomes homogeneous and clear. Then the furnaces are allowed to cool until the contents of the pots become pasty and viscid, the proper working state; and the heat is subsequently maintained at a degree sufficient to keep the glass in this condition.

At the Exposition, the glass is mostly pressed at once into the required form. Some blown glass is made, but the sketches shown on our initial page relate mainly to the former operation. The mold, which is represented taken apart, so as to show its construction, is one of those designed for pressing goblets. It consists first of two hinged iron pieces, in each of which are hollows, corresponding in shape to the portion of a goblet below the bowl. The ring portion shown, above the mold proper, holds the glass which forms the bowl of the goblet, and the still smaller ring above fits in the one just mentioned and limits the height of the bowl in the mold. Lastly, the conical plunger enters the bowl portion, and between it and the mold the glass is pressed into proper cup shape.

The mold is placed on the greased metal table of the press, as represented in the sketch, and the plunger is attached to a screw rod which passes through a crosshead which slides on vertical guides. The cross head is eccentrically connected to disks on the side of the machine by pitmans, and to one of these disks is secured the long lever manipulated by the workman. The apparatus being ready, a "gatherer" takes a long iron rod called a punty, to the end of which a little ball of viscous glass is attached. This he dips into the pot of molten glass, and twirls it around until a moderate sized nodule is gathered on the end. Carrying his rod over to the press, he holds it so that the glass slowly drops into the mold, until the workman deems that a requisite quantity has entered, when a pair of shears is used to clip off the material. If too much glass remains on his punty, the gatherer rolls it along the edge of the iron slab beside the pot of water shown, when the excess of glass falls hissing into the water, and the remainder is rolled into a neat ball. The pressman now pushes his filled mold under the plunger, seizes his lever, and forces the plunger down with such force that the hot glass is driven into every crevice of the mold. A moment of waiting follows, the plunger is thrown up by the action of heavy spiral springs, the mold is drawn back and opened, and there stands the goblet, rapidly changing from cherry red to its natural transparency. An attendant now has ready a punty with a bit of hot glass at the end, which he deftly attaches to the bottom of the article, to serve as a long stem. The goblet is thus carried to the glory hole, a smaller furnace, and here it is reheated. This gives it its subsequent polish. While hot and blackened, it is removed and passed to a workman who sits on a bench on each side of which are long inclined iron-covered arms. Taking the stem or punty in his left hand and resting the object on one arm of his chair, the workman rapidly rolls it forward and back, holding meanwhile inside the bowl a flat piece of charred stick termed the "battledore." This smooths the glass and renders it perfectly circular in shape. Next the punty is removed, and another stem is attached to the bowl portion, as shown in the sketch. The glass is again rotated as before, and the workman now holds against the bottom the flat upper portion of his tongs or "puccellas." This tool is represented separately in the engravings. The effect of this is to smooth the bottom and render it perfectly flat.

When these operations are concluded, a boy seizes the glass in a fork, and carries it to the annealing oven and stands it on the floor. Here the annealing is continued over several hours at a low heat; and as it concludes, the floor of the oven is carried rearward, so that the glass passes into cooler compartments and finally is withdrawn at the rear. Grinding the bottom smooth on a grindstone follows, and any engraving or like ornamentation is done. Nothing then remains except to polish the glass, when it is ready for the market.

When glass is blown, of course no pressing operation comes into use. The blower first gathers the requisite amount of glass on the end of a long tube and rolls it on a smooth polished cast iron slab called a "marver" until it assumes a cylindrical form. Then he blows into the tube, expanding the glass as much as he thinks necessary, and also swinging the tube when he desires to elongate the object; then by means of tongs, scissors, and battledore, he molds it into the desired form. After the shape is once produced, the subsequent operations are similar to those already described.

THE MEETING OF THE NATIONAL ACADEMY OF SCIENCES.

We give below our usual brief abstracts of the principal papers read before the above-named body at its recent meeting in Philadelphia.

General H. L. Abbott gave a synopsis of the results obtained by his observations of the

VIBRATIONS FROM HELL GATE.

The instrument employed at the various stations, for noting the vibrations, was a seismograph, which principally consists of a basin of mercury, giving what is called an horizon of that metal. The agitation of its surface when the vibrations reach it is observed by telescopes with delicate means of measurement. So easily is it disturbed that the foot-fall of a horse 300 feet away is at once indicated. A number of experiments led to calculation that the explosion on Hallett's Reef, where 3,680 charges were fired simultaneously, ought to be indicated at 59 miles; but General Abbott was very anxious to obtain something more than negative or

doubtful results, and hence selected distances not much over 9 and 12 miles. An observation was attempted at West Point, 52 miles away, and no results were obtained. The stations used by General Abbott are all on Long Island; their distances from the reef were very accurately ascertained, and are given in round numbers in the table below:

Stations.	Distance, miles.	Arrival seconds.	Velocity of transmission in feet per second.
Fresh Pond Junction.....	5½	63.0	3,873
Jamaica.....	9½	23.5	4,521
Willett's Point.....	8½	72.3	8,306
Springfield Junction.....	12½	19.0	5,309

The sound, as distinguished from the rumbling of the earth, is described as a dull roar such as comes from a torpedo explosion at a distance. At Springfield Junction, the noise is spoken of as a low, rumbling sound, gradually increasing to a maximum and then dying away.

General Abbott said that he had never seen so quick an explosion. Within half a second of the actual time of firing, the water of the East River thrown up had reached half its height. During the discussion, Professor O. N. Rood referred to Professor Mayer's experiments at South Orange, N. J., which gave for the vibrations from this explosion a speed of about 3,000 feet per second. Professor Henry mentioned the curious coincidence that the boiler of the Lighthouse Board's steamer sprung a leak at the time of the Hallett's Point explosion; steam had been blown off just previously. It was also mentioned in connection with the theories of vibration that nitroglycerin will tear gun cotton to pieces if exploded upon it; but the cotton does not explode. But if the converse experiment be tried, the explosion of gun cotton sets off the nitroglycerin. Gun cotton will not explode gunpowder.

Professor Loomis discussed

LAST SUMMER'S HOT WEATHER.

and stated that during the whole "heated term," a low barometer was associated with high temperature. On a very hot day, especially selected for observation, the excess of heat was about 20°. Of this about 10° may be fairly attributed to southerly winds bringing hot air from the more heated regions to the south of us. For the other 10°, Professor Loomis proposed to account by the prevalence of extraordinary dryness at the northwest—a region usually dry indeed in summer, but in this instance subjected to unusual drouth, while southerly winds, sweeping over it, kept back the north wind by which it is ordinarily visited at intervals. Here a stratum of heated air was continually formed, which supplied to the general weather of the country 10° of the extra 20°.

THE SUN'S TEMPERATURE.

The actual heat of the sun's surface is one of the unsettled questions of Science, and estimates have varied between 10,000,000°, and 2,700° Fah. Professor S. P. Langley read a paper detailing how he compared the sunlight with that from the molten steel poured out of the Bessemer converter, and thus approximately estimated the solar temperature. A heliostat arrangement was employed to transmit a sun-beam into the foundry of the Edgar Thomson Steel Works, and a Ritchie photometer was used to measure the respective intensities of the lights. The first conclusion reached was that the sun's light, which turns the light from the molten steel into a black spot, must be at least 50 times the greater. Then the spectroscope was employed and the two rays compared. The steel rays were again blotted out. Hence the sun rays must have been at least 64 times brighter. Next, Professor Langley made comparisons of the sun's rays with those from the flames above the converter, when the latter were at their brightest. This was a less difficult proceeding and furnished more specific results. The photometric comparison could be made directly. It is admitted, however, that the flame light may not be quite as bright as that of the molten steel. The arrangement was somewhat like that of a camera obscura. It gave the image of the sun so accurately that sun spots could be easily examined; it also gave an exact representation of the furnace flame. Each was alternately superposed on the other. The conclusion is that the sunlight is at least 2,168 times brighter than the furnace flame. As the heat is presumably of the same relative order, the result is adverse to the law of Dulong and Petit. The actual heat of the sun is probably among the higher values that have been suggested.

Professor Henry's important paper on ocean echoes we reserve for fuller review.

Correspondence.

Centennial Awards.

To the Editor of the Scientific American:

In your issue of October 28, on page 273, are some editorial comments, to which a few additions may usefully be made.

If there are a large number of awards, it must be remembered there are a large number of exhibits; and there may be a few judges or groups of judges that did not fully comprehend their duties, the consequence being that mistakes may have been occasionally made. I know, indeed, that some judges have not recognized the difference between a report and an award, and that awards have been made which are mere copies of the reports by secretaries of groups, who did not quite understand the difference; and the General Board of Judges could not go well behind these awards without the greater chance of injustice to the exhibitors. I fancy, however, that these cases must be very few. I have been a juror in a group that has had almost continuous exercise since the beginning; and considering the novelty of the

plan, I am surprised to see how few are the exceptions to its working well.

Your statement of the plan is not quite correct. You say "The judges simply write reports on exhibits which they deem commendable, and the Centennial Commission thereupon decides which out of the exhibits so reported on are entitled to the medal and diploma." I will not say what some groups of judges may have understood to be their duties; but our group not only reported on those they deemed commendable, but on every person's exhibit. The failure to send in descriptions, to which you refer, made no difference; these requests for descriptions were only to ascertain what the exhibitor claimed. If no description came, the judge used his best judgment. The Centennial Commission did not select, from our report, the awards. We selected them ourselves from our own reports. These have to be confirmed by the Commission. The actual merit of every man's exhibit is the matter of the report; the special merit, the matter of the award. To show you that awards are by no means so freely scattered as you suppose, I will say that, in one particular line of articles, I examined five hundred and twenty-six different exhibits, and have notes of each exhibit on my judge's memorandum book; only forty awards were made.

It is quite possible that some of the judges have not understood their duties under the system, or the system itself; but this should not militate against the whole system, which, from the extended experience I have had of it now, I believe to be the best ever devised, and far superior to the old plan of specified premiums for specified articles, of which, too, in times past, I have had an ample experience.

Philadelphia, Pa.

ONE OF THE JUDGES.

(For the Scientific American.)

CUTTING A LEFT HAND SCREW WITH A RIGHT HAND TAP.

J. W. S. sends us an interesting letter upon a method of cutting a left hand screw with a right hand tap, which we herewith illustrate. Fig. 1 represents a piece of iron with

Fig. 1.

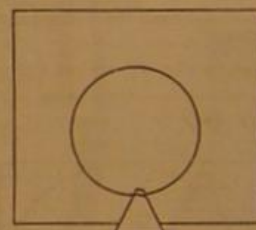
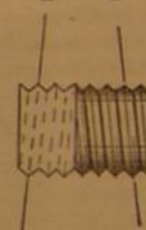


Fig. 2.



the hole (of the size of the bolt to be threaded) drilled in it. A V slot is then cut in it, and a tap ground to an angle with the thread left on the narrow end, which projects into the hole. If, then, the bolt is placed in the hole and the tap in the V slot, and we screw the whole into a vise, with the jaws gripping the back of the tap and the opposite side of the piece of iron, the pressure of the vise will hold the tap and force it to its cut, which is taken by screwing the bolt through the hole in the piece of iron.

The reason why this can be done is as follows: Suppose that Fig. 2 represents a piece of iron with a thread cut upon it, and that at one end it is filed down to half its diameter, as shown: it is evident that the side of the thread furthest from the observer stands at an angle slanting from the left to the right, during half its circumference, as denoted by the line, A, shown; so that, if we commence at the bottom and follow the thread for one half a revolution, we shall advance in the direction of A; whereas, if we perform a similar operation, beginning at the bottom on the other side of the thread, we shall, in moving half a revolution, travel in the opposite direction, B: showing that, notwithstanding that the thread advances in one direction, its threads slant in an opposite direction on one half of the circumference as compared to the other.

J. W. S. uses one side of the thread to cut the other with, and thus reverses the angle; and if he will turn to page 21, volume XXXI, SCIENTIFIC AMERICAN, he will find the same principle explained for cutting up inside chasers, in which operation a chaser, to cut a right-handed thread, must, to have the teeth start in the right direction, be cut off a left-handed hub. J. W. S. has, however, given us a new application of the principle.

J. R.

New York city.

Watering House Plants.

If the causes of failure where plants are cultivated in windows were minutely investigated, the system of watering would be found to be the principal cause. A plant ought not to be watered until it is in a fit condition to receive a liberal supply of that element, a good drainage being previously secured, in order that all superabundant water may be quickly carried off. Those who are constantly dribbling a moderately small quantity of water upon their plants will not have them in a flourishing condition for any length of time. This must be obvious to all, for it is quite evident that the moderately small quantity of water frequently given keeps the surface of the soil moist; while at the same time, from the effects of the good drainage, which is essential to the well being of all plants in an artificial state, all the lower roots would perish for water, and the plant would become sickly and eventually die. In many instances when the contents of flower pots are sprinkled daily with water, the soil in the middle will become hard and dry. When the ball of earth becomes dry, it takes water a long time to penetrate it, and surface waterings do not accomplish the object. In this case set the pot in a pail of water, and let it soak until the earth is thoroughly wetted through. If pro-

per care in the respect above mentioned fails to induce a proper growth, then the plant must be re-potted with fresh earth, and have a portion of its top cut back. Irregularities in shape must be corrected from time to time by pinching off the shoots which may start to grow out of place.

The red spider is quite averse to moisture; the green fly, however, likes it, but may be destroyed so readily by tobacco smoke that only neglected plants will suffer from this cause. The mealy bug is so large that it may be easily picked off.

Watering must be properly attended to; and while the plant must not suffer from lack of moisture, the roots must not be kept saturated with water. The sound of the pot when struck by the knuckles is quite different from what it is when dry. This, and the lagging look of the plant, will indicate that water is needed. A little practice will soon enable one to anticipate the wants of the plant and to supply water at the proper time. Plants growing in a cool atmosphere will be found to flourish much better by giving them water which is almost hot. House plants that have bloomed freely during the winter should be denied their usual supply of water, and be placed in the open air for a few hours during the middle of bright days, if this course is practicable.

PRACTICAL MECHANISM.

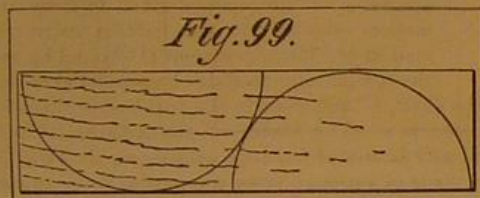
BY JOSHUA ROSE.

SECOND SERIES—Number XIV.

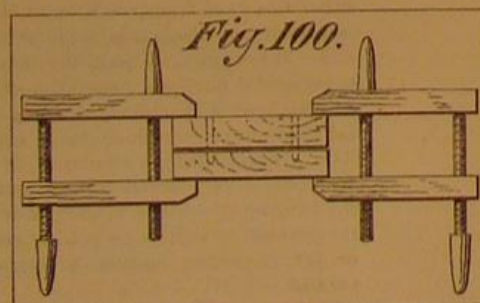
PATTERN MAKING.

The construction shown in Figs. 92, 93, and 94 is so nearly the same, and the slight difference is so obvious, that an explanation of Fig. 94 will cover the ground. For Fig. 94 we plane up a piece of wood twice as long and more than half the size of the required flange, and out of this piece cut the two half flanges. If, however, the flange is of sufficient size to make it necessary to study economy, the two half flanges may be set out on the plank, lapping each other, as shown in Fig. 99. We next, with a flat scribe, draw a line on the chuck exactly through its center, and set the half flanges to this line, and then screw them to the chuck and turn them as if they were solid. By setting the halves exactly true to the line, it is insured that the flange shall part exactly at the center.

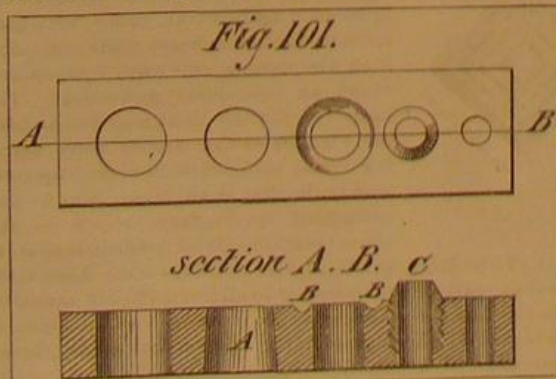
To make the pattern shown in Fig. 93, we take two pieces



of wood long enough to make the two halves, and allow about half an inch or an inch to turn off each end, so that the impressions of the fork and center may not appear on and disfigure the finished work, and for other reasons hereafter to be mentioned. We plane these pieces on one edge and on one face, making them of equal thickness. We make the flat surfaces, which come together, true, trying them with the winding strips shown in Fig. 37, to detect any twist. Our next operation is to insert the pegs, and we may, for this purpose, adopt either of the two following methods; the more ready of which we will take first: Clamping the two jointed faces together, as shown in Fig. 100, we bore



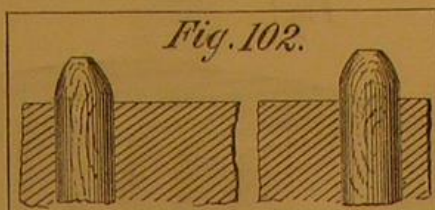
two holes right through the top piece and into the bottom, one to a little greater depth than the height to which the pin is intended to project, as shown by the dotted lines. We then plane up a piece of hard wood, about two and a half feet long, to fit the holes tightly. It is just as easy to plane a long piece as a short one, and what is left over will serve for a future occasion. A useful tool for preparing pin stuff is illustrated in Fig. 101, which represents a hardened plate



of steel, pierced with holes of the sizes of the pins usually required. The wood for the pins, having been planed up to the required size, is driven with a mallet through the plate, saving a great deal of time, and making the pins more nearly round than is possible by hand work. In some of these

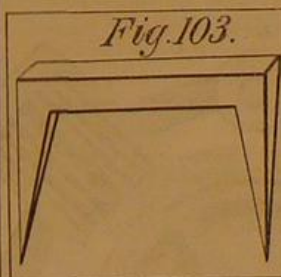
plates the holes are made taper, as shown at A, in Fig. 101; this, however, is detrimental, and the parallel hole is the best, because it guides and supports the stick while it does not impede the cutting action of the tool. A hollow formed around the edge of the hole, as shown in the sectional view, at B B, would improve that action; or it might be still further improved by inserting bushes in the plate, with a portion left projecting above the plate and beveled off to resemble a chisel, as shown at C.

The pin stuff being prepared and inserted into one half of the pattern, the projecting end is then tapered off as shown in Fig. 102. The formation of this projecting pin may seem

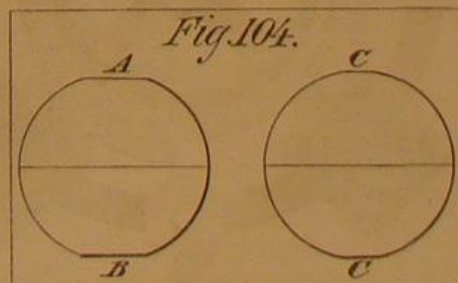


a very simple matter; but if sufficient consideration is not given to it, a great deal of annoyance is caused to the molder, and the castings will be imperfect. If we reflect for what purpose these pins are inserted, we shall find the proper shape. First, with regard to the projecting length, some workmen seem to be guided by the diameter of the pin, making it project to a distance equal to its diameter; but it is obvious that a short peg or pin will govern the position as well as a long one, and will be less liable to stick in the loose half of the pattern: hence it is better to let the protruding end stand out from three sixteenths to one half inch, and let from one sixteenth to one eighth inch of the large part fit the hole, the nut being tapered off so as to be sure that the pin can be released easily. These conditions inevitably bring us to the parabolic form shown in Fig. 102. Another point to be observed is to make the pin of as large a diameter as is consistent with the work; for the larger the pin, the longer it will remain free from shake. Above all, it is essential that the pin be perfectly round at the part that fits the hole; and if these elements are neglected, castings will be produced of which the halves will not match, which is always very unsightly. Nothing is gained by making the pins to a tight fit in the loose half of the pattern, as they will not work that way; and the molder will enlarge the holes with a red hot rod, and then, after a little while, the charred part around the hole falls out, and the pin becomes too slack.

After inserting our pins, the two halves of our patterns are to be fastened firmly together; and this may be readily done by brushing the end faces with hot glue for a breadth of one half or one inch, according to the amount we have allowed our pieces to be larger than the finished work. Then we hold them firmly together with a screw clamp, leaving them until they are perfectly dry. If there is not time for the gluing, the two halves may be screwed together; and indeed, if the job be a heavy one, it will not be safe to trust entirely to glue, but to use screws or dogs. Dogs are a kind of square staple, made of steel, and of the form shown in Fig. 103; and two of them driven in each end of a pattern will hold its loose halves very firmly together. While very



handy, however, on large or small work, they are cumbersome; and the gluing or screwing is preferable. The work can now be mounted in the lathe, and turned as though it were solid. Care must be taken that the center points are exactly in the joint, and it was to ascertain if this was the case that our two halves were planed of



equal thickness; for if, in the process of turning, one flat is seen to be narrower than the other, as shown in Fig. 104, at A B, it is proof that the centers are not in the joint; and unless the error is corrected, one half of the finished pattern would be thicker than the other. To remedy the error, we tap the pattern lightly with a hammer in the required direction, and then screw up the lathe centers a little more, continuing the process until the flat sides upon the pattern, when very nearly trued up, as shown in Fig. 104, at C C, are equal, and finally disappear.

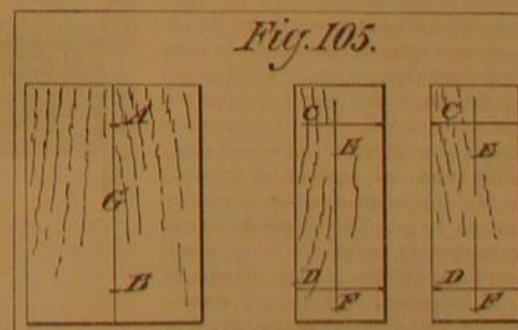
Our pattern being then turned and sandpapered, as already directed, the next proceeding is to stop up all holes or cracks that are not desired to appear, with either beeswax or putty. This is a simple process, but it may have been noticed that some workmen take a much longer time over it than others, at least when beeswax is the stopping material. One who is expert at this work guesses just the proper amount necessary for each hole or crack; then he forms the wax into a worm-like shape, and with a warm chisel (that is not hot enough to make the wax run but only to

cut it easily) he presses the wax into the hole, and seldom leaves any surplus to remove. The same knack is necessary in filleting, that is, in filling in an internal square sharp corner, when it is thought too small to be filled in with wood; for if the worm or string of wax of the right size be laid along the corner, the pressure of a warmed gonge will cause it to expand to the required fillet; while if too much wax is inserted, much time will be occupied in trimming off the surplus.

The third and last of the finishing processes is the application of two or more coats of spirit varnish, which adds to the appearance of the pattern, and increases its durability by giving it a surface impervious to water, and by producing that smoothness so necessary for its easy extraction from the sand. A varnished pattern escapes much of the rough usage commonly bestowed upon patterns, because the molder does not rap it so much as he otherwise would do. Several thin coats of varnish give a much finer appearance than fewer and thicker ones. The first coat fills up the pores of the wood, and frees the fibrous projections left by the sand paper; and after the first coat is dry, fine sand paper is again applied to remove the fibers so fixed. The second and succeeding coats give the gloss.

The pattern maker invariably mixes [his own varnish, which he does in the following manner: The varnish pot should be of stone, and not of iron, which would discolor the varnish. The cover should be of thick leather, having through the middle a hole of such size that the brush handle, forced through it, will be suspended, and will not pass through to the bottom of the pot. The object of making the cover of leather is that the varnish collects around the lid and sticks the cover down, requiring sometimes so much force to remove it that wood would be liable to split. In the pot is placed so much shellac, and there is added just sufficient alcohol to cover the shellac, the whole being occasionally stirred with a piece of stick, and not with the brush. The consistence should be that of raw linseed oil; and to hasten the mixing, a little warmth may be applied. The color of the varnish used is, strictly speaking, optional; the usual plan, however, is to use clear varnish for the pattern, and black for core prints and the insides of core boxes, which thus distinguishes them. The black is made by adding the best dry ivory black to the clear varnish. A very durable varnish may be made by adding powdered oxide of iron to the clear varnish, which gives a hard varnish with a reddish brown color. In mixing colored varnishes, however, we must remember that the lighter the pigment, the easier they work. Ivory black is the lightest pigment, and so always pervades the varnish, and does not readily settle to the bottom; hence it does not often require stirring. Oxide of iron requires frequent stirring, even in the course of varnishing one pattern, if it be a large one; because it settles so rapidly that a perceptible difference in the coat is apparent unless the varnish is stirred previously to each insertion of the brush. The brush should never go to the bottom of the pot, and the pot should always be kept covered when not in actual use. Varnishing lathe work cannot be done while running the lathe; but after the work is varnished, running the latter hastens the drying. Work should always, if possible, be varnished on a dry day; for if the air is damp, the varnish becomes what is technically termed chilled, that is, it assumes a soapy or milky appearance, as though it had absorbed water, and hence is spotty when dry.

Having thus finished our example, we may now explain the process of putting pins in patterns, which we omitted to do, when speaking upon that subject, to avoid digression. There are many cases in which it is not suitable for the pin hole to show on the outside of the pattern; and again, in large work, the holes would require to be bored so deep and the pins made so long that it would be too elaborate an affair altogether. In such circumstances, lines are resorted to, being drawn in the following manner: Place the pieces side by side, with the planed edges touching and the ends fair, as shown in Fig. 105, the line, G, representing the edges; and make two fine notches at A B. Then separate the pieces,



and square the very fine lines, C C, D D, across with a knife. Then set a gage to half the width of the pieces, and mark the intersecting lines, E E; and the centers for the respective pin holes will be the intersection of the lines, C E and D F. If, however, we have no planed edge to work from, and the job is of such size as to involve so much labor as not to admit of planing, we may take two small brads or finishing nails (or as many as we desire to have pins), and drive them almost entirely into one piece of the wood in the spots where the pins are ultimately to be, and then file the projecting part of each to a point. By then resting the other half in its proper relative position upon the filed points, and, when adjusted, applying a little pressure to it, the nail points will enter the top piece and mark the corresponding centers for the holes to receive the pins. We may then extract the brads or nails, and proceed to bore the holes and insert the pins.

IMPROVED RIBBED BALE TIE.

We illustrate herewith a new and very simple tie for cotton and hay bales, etc., which is quickly adjustable, and is claimed to allow of no expansion of the bale after it is secured. This is an important consideration, as the bales always expand several inches in thickness after leaving the press, and, through their bulk, cost more for freight and storage than would be the case did the bands hold them in the shape given by the pressing. In Fig. 1 the tie is shown applied, and in Fig. 2 it is represented on a large scale. The novel feature consists in making slightly raised ribs on the band, at something less than an inch apart. The buckle is a mere frame with a cross-bar, A. The band is applied ribs inward, and the end is inserted through the buckle, as shown in Fig. 2, and under the part to which the buckle is attached. The cross-bar, A, and front part of the buckle are suitably beveled to enable the end to be easily inserted and fastened without bending the band. The ribs, being formed along the entire length of the band, enable it to be adjusted to any size of bale. The employment of the device in no way damages it, so that it may be repeatedly used.

This bale tie is in use by many of the largest cotton-packing firms in the South, among whom are Hadden & Avery, Memphis, Tenn., Dunn, Ogletree & Co., Atlanta, Ga., and Woodruff & North, Selma, Ala.

Patented July 11 and 25, 1876. For further particulars address the manufacturers, Messrs. P. Hayden & Son, Columbus, Ohio.

Ozone Produced by Waves and Fountains.

The mechanical action of pure air over vegetation is productive of ozone, but still more manifestly is this subtle quality produced by the dashing of waves and spray against the air. These lashings of air and sea mixed are, electrically speaking, in the nature of one substance rubbing on another. They evoke ozone, which, being inhaled in breathing, gives a stimulus to the constitution. Hence the benefit to health from a sea voyage, or a residence at a pleasant seaside resort. Mr. Binney stated, at a recent meeting of the Manchester (England) Literary and Philosophical Society, that the atmosphere of towns may be sensibly ozonized, and of course improved in quality, by the action of public fountains. He says: "A water fountain may be regarded as a hydro-electric machine, the friction of the water issuing through the jets developing electric action, materially assisted by the conversion of the spray into aqueous vapor. I would suggest that this fact should be prominently brought before municipal bodies, to induce them to erect fountains in all available places in large cities, as sanitary agents. They might prove highly beneficial in crowded localities."

THE CAMACHO ELECTRO-MAGNETIC ENGINE.

The following description, with the diagrams annexed, from the *English Mechanic*, will enable the reader to obtain a tolerably correct idea of the new electro-magnetic engine patented by M. José S. Camacho, of Paris, and which has attracted considerable attention from students of electricity and motive power. The invention consists mainly in the employment of an improved armature and the arrangement of the commutator, by means of which the speed and power of the engine can be varied; but M. Camacho claims the use of tubular magnets for the purpose, as well as his improved armatures and commutators.

The new engine may be constructed according to two modifications, the electro-magnets being stationary, and the armatures movable, or *vice versa*. In both cases the principle of the apparatus remains the same, the details only of the engine being varied. The armatures are formed of metallic plates insulated magnetically from one another, in order to cause the engine to generate a greater amount of force. The magnetic inertia of a temporary magnet is so much greater in proportion as the volume or mass is increased; consequently a comparatively long time is required for it to attain its maximum of magnetization if the mass is considerable. Moreover, in the case in question, and when the armature is placed in proximity to the magnet, it has a tendency to become magnetized throughout its whole extent. It should further be observed that the nearest part of the magnet (which is alone effective) cannot attain its maximum amount of magnetization except at the same time as the whole of the armature—that is to say, when the latter has arrived opposite the magnet. Now it is precisely at this instant that, in rotatory electro-magnetic engines, the passage of the current, which produces the attraction, would cease; whence it results that the armature has finished its course or travel without attaining its maximum of magnetization; and consequently a great diminution of the force, which would otherwise be produced by the en-

gine, ensues. In order to remedy these defects, the armatures of M. Camacho's electro-magnets are composed of a suitable number of metallic plates or blades, arranged normally at the acting surface of the electro-magnets, and magnetically insulated from one another by the interposition of any suitable substance which forms a bad conductor—such, for example, as paper, resin, and the like, and even certain metals which form bad conductors of magnetism. "In this manner the magnetization is produced successively in each of the plates of which the armature is composed, which, in

electro-magnetic engine, in which the electro-magnets are fixed or stationary, and the armatures are movable; Fig. 2 is an elevation of one of the electro-magnets, and Fig. 3 a horizontal section of one limb of a magnet, a longitudinal section being shown in Fig. 1; Figs. 4 and 5 show the improved commutator.

The electro-magnets, A (shown detached in Fig. 2) are four in number, and fixed at equal distances apart from one another between two disks, B, serving as a frame and support to the whole of the apparatus. (One disk only is shown in the figure.) The movable part of the engine is composed of a shaft or axis, C, upon which are fastened recessed or hollow disks, D, to which the armatures, E, are attached. These armatures in the present example are three in number, and they are formed, as before mentioned, of a series of plates or blades of metal insulated electrically from one another and arranged in parallel or radiating positions, as shown in the engraving. The shaft, C, also carries the commutator (F, Figs. 4 and 5), in contact with which roll four rollers, each of which is in communication with one of the electro-magnets, A. The current enters the apparatus by a binding screw attached to the frame or disk, B, passes thence into the shaft, C, and into the commutator, F, whence it reaches the rollers, which direct it successively to each of the electro-magnets, A, by the intervention of binding screws insulated from the frame, and fixed on a disk of wood or other insulating material. The current issuing from the electro-magnets passes to binding screws attached to a metallic ring, which unites them all, and which is insulated from the frame by a disk of wood or other suitable material; the current then passes off by a binding screw to return to the battery. The positions of the binding screws on the metallic ring are shown in dotted lines.

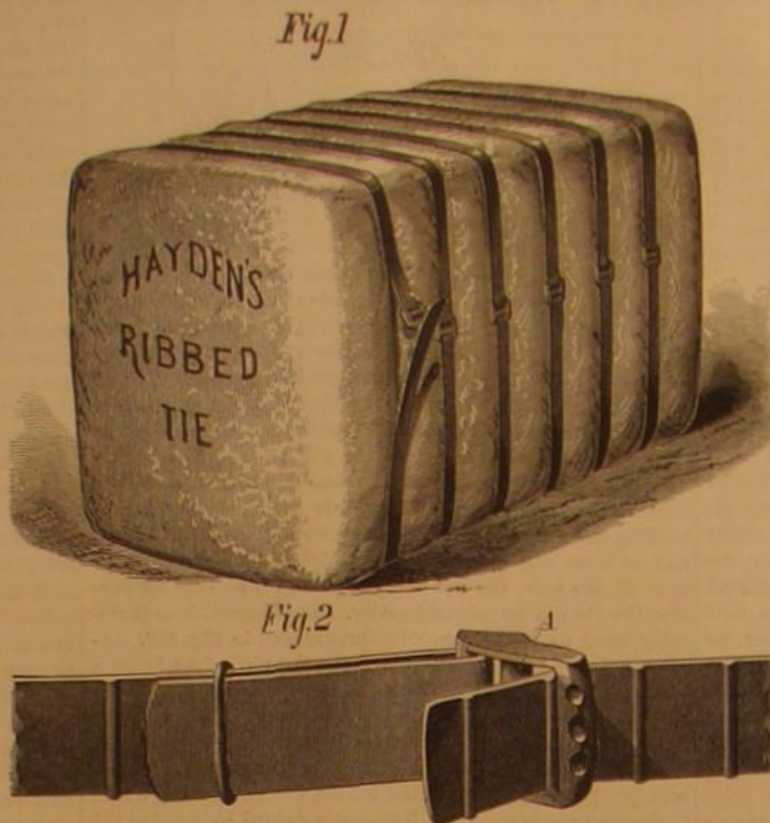
An ordinary commutator may be used, but M. Camacho prefers the improved commutator, F, shown separately in Figs. 4 and 5, which is provided with triangular contact makers, admitting of the duration of the passage of the current being varied or regulated in each electro magnet, according to the position given to these contact makers relatively to the friction rollers before spoken of. The adjustment is effected by causing the commutator to slide along parallel with itself upon the shaft, C, and when in the required position is held by the set screw. The blades of the armature, which are magnetically insulated from one another, as shown in Fig. 1, may be made of a triangular or trapezoidal form in section; but as previously stated, for the sake of greater simplicity the armatures may consist of any suitable number of metal blades with parallel faces arranged in juxtaposition, but magnetically insulated from one another by any suitable means. The electro-magnets employed in the engine are by preference constructed of tubes of a cylindrical, rectangular, square, or other convenient section, an example of which is shown in Fig. 3; but ordinary electro magnets with solid cores may be employed, arranged in any required number round the apparatus.

The engine may be constructed of any dimensions. Bars or bolts are shown at T, Fig. 1, for the purpose of securing it either to a fixed framework or to the object itself, to which it is to impart motion. It is applicable, says the inventor, to industrial purposes generally, such as driving sewing machines, working musical instruments, machine tools, and the like. It may also be employed, by constructing it of suitable dimensions, for the hauling of vehicles upon rails or upon the ground, as well as propelling vessels, or for imparting motion to other apparatus.

Coast Lights Injured by Birds.

It is a curious fact that, during the months of April and October, keepers of lighthouses along the coast are obliged to exercise the greatest vigilance in order to prevent injury to their lights through the breaking of the lantern glasses by birds flying against them at night. Ducks often dash against the panes with such force as to shatter heavy plate glass, and even wire netting, now used, is sometimes found an inadequate protection. The keeper of the new light near St. Augustine, Fla., states that almost every morning during last month he picked up from twenty to fifty dead birds, which had committed involuntary suicide in the above manner. It is estimated that at each of the large lighthouses on the coast some 2,000 birds are thus yearly slaughtered, or in all about 100,000 annually. The circumstances also serve to indicate that the flight of the birds, which migrate during the months named, is accomplished in the night.

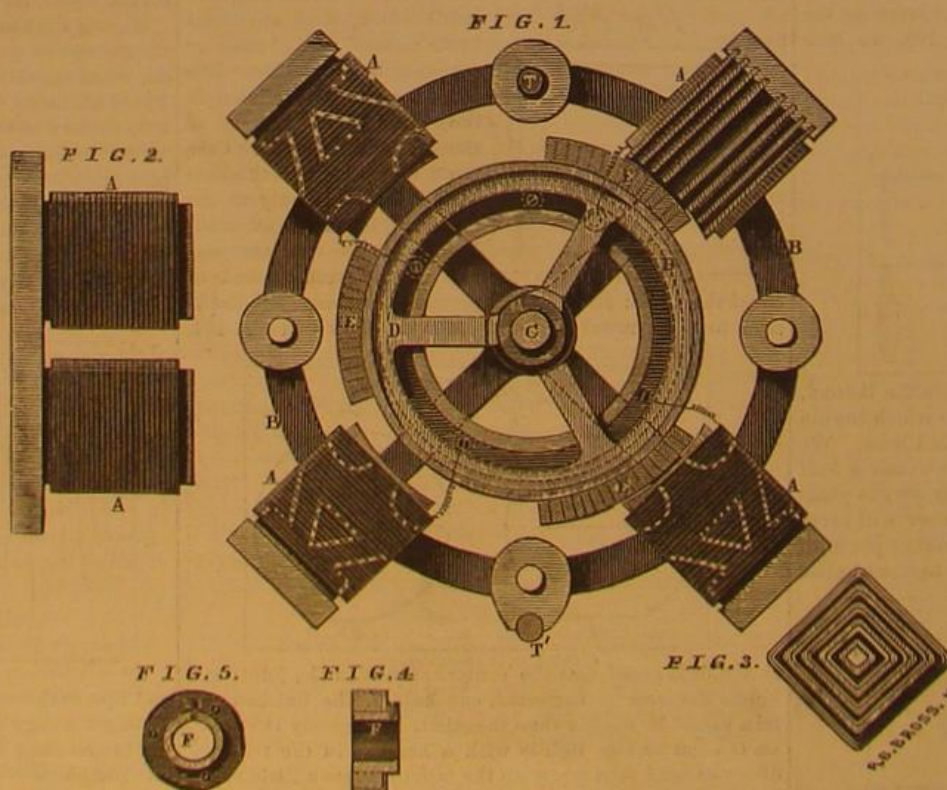
VARNISH FOR SILVERWARE.—Gum elemi, 30 parts; white amber, 45; charcoal, 30; spirits of turpentine, 375. It must be used in a heated state, the metal to which it is to be applied being also heated.



HAYDEN'S RIBBED BALE TIE.

consequence of their small volume, are thus brought to a condition of maximum magnetization as soon as they come within the range of magnetism of one of the electro-magnets of the engine, and the travel of the armature is completed in maximum magnetization, giving greater production of force with the same expenditure of electricity. As this effective force is the product of forces multiplied by velocities, it is also evident that an increase in the effective force is produced by reason of the greater rapidity of the magnetization and demagnetization of the armatures formed of insulated plates or blades."

In the new commutator the piece of metal or contact maker, serving as a conductor, instead of being made rectangular in shape, is constructed in the form of a trapezium



THE CAMACHO ELECTRO-MAGNETIC ENGINE.

or triangle, so that the rubber which acts against it continues in contact therewith, during only a fraction of a revolution, varying according to the position in which the contact maker is placed. It will thus be seen that it suffices to advance or draw back the commutator upon its axis of rotation, while the rubbing surfaces of the engine remain stationary in order to modify the passage of the currents in the electro-magnets, and consequently to regulate the speed and power of the engine.

In the diagrams, Fig. 1 is a transverse section of a rotary

THE GRINDSTONE COLUMN AT THE CENTENNIAL.

It would hardly be imagined that such homely objects as grindstones could be grouped tastefully and even elegantly, and yet an enterprising manufacturer of these useful articles (Mr. J. E. Mitchell, 310 York avenue, Philadelphia) exhibits his productions at the Centennial Exposition in so artistic a manner as to challenge universal admiration. From the center of his allotted space, which is located on the southern main passage in Machinery Hall and near the Corliss engine, rises a superb Tuscan column, twenty-six feet high. This is composed of thirty-six grindstones of different grits and qualities, piled one above the other. Slight variations in diameter of the stones produce the graceful swelling outline of the pillar; and their different colors, ranging from red to bluish, gray, and yellow, are harmoniously combined to produce the effect of tinted bands. The general appearance of the column is shown in the annexed engraving, and it forms one of the most prominent objects in the vast display.

Mr. Mitchell's exhibit is not merely artistically attractive, but is also one of those sensibly arranged contributions from which any one, studying them, can obtain, by simple inspection, a fund of useful knowledge. For instance, there is a collection of mounted grindstones from which the machinist may learn all the different modes of adjusting the stone, and make valuable comparisons. He may also see all the various kinds of stones, and thus note the differences in grit, and determine which is best for his own especial purpose. There are huge stones weighing from 1,000 to 4,000 lbs. each, such as are used for grinding saws, files, edgetools, and cutlery, for beadstones in nail works, and for finishing the iron work of locomotives. Thence downward, every size of stone may be examined, to the smallest made.

Three medals have been awarded to Mr. Mitchell for this exhibit. A very interesting pamphlet, on the subject of grindstones, their history, and how to hang and use them, may be had free by addressing the manufacturer above named.

The Physical Properties of Gallium.

M. Lecoq de Boisbaudran, in a recent note to the French Academy of Sciences, states that he has prepared about $7\frac{1}{2}$ grains of gallium. In liquid state, the metal is a beautiful silvery white; but in crystallizing it turns blue, and its brilliancy becomes greatly diminished. The point of fusion is fixed, for the metal melts very slowly at 86.27° Fah., and crystallizes very slowly at 86.09° . The density of the specimen is 5.935. Gallium crystallized under water crepitates sometimes on heating.

FLYING LIZARDS.

The remarkable lizards of our Western hemisphere, properly termed the iguanas, have their counterparts in the agama family of the East. The tribe contains between thirty and forty genera, and many of them are peculiar and interesting. Our engraving represents, first, the fringed dragon (*Draco fimbriatus*), which is commonly found in Sumatra. The head is grayish white, covered with an irregular network of dark brown, and on the throat are a number of circular specks covered with granular scales. Upon the under parts of the male, the scales are rather large and keeled; and upon the wings are a number of rather short, white dashes of a partly triangular shape. Along the sides run series of small triangular keeled scales.

The other specimen shown in our illustration is also a so-called flying lizard, called the flying dragon (*Draco volans*). It is a native of Borneo, Java, the Philippines, and the neighboring islands. The prominent characteristic of this reptile is the singular developed membranous lobe to be found on each side, which lobes are strengthened by certain slender processes from the six false ribs, and serve to support the animal during its bold leaps from branch to branch. The flying dragon is the most agile and daring of the winged lizards; and it can leap a distance of 30 paces, its so-called flight being similar to that of a flying squirrel or flying fish. The color of this reptile is variable, but is usually as follows: The upper surface is gray, with a tinge of olive, and daubed or mottled with brown. Several stripes of grayish white are sometimes seen on the wings, which are also ornamented with an angular network of dark blackish brown. When the dragon is at rest or even traversing the branches of trees, the parachutes lie in folds along the sides; but when it prepares to leap from one bough to another, it launches into the air and sails easily, with a slight fluttering of the wings. It makes itself more buoyant by inflating the three membranous sacks that depend from the throat. It has been commonly supposed that these animals gave rise to the fabled dragons of the ancient mythologies; but the probability is that the real clue to the origin of the monster is to be found in the gigantic saurians of ancient times, which were

found on earth for some time after man made his appearance on the planet. We select the engraving from Wood's "Illustrated Natural History."

Fall of a Meteorite in Kansas City.

Mr. J. D. Parker, in a letter to the *American Journal of Science*, says: "On June 25, 1876, between the hours of nine and ten in the morning, a small meteorite fell upon the



MITCHELL'S GRINDSTONE EXHIBIT.

tin roof of Mr. Isaac Whittaker's business house, No. 556 Main street, Kansas City, Mo. The meteorite came down with sufficient force to cut a hole in the tin roof on the front part of the house near an open window; but not passing entirely through the tin, it bounded back a few feet and lay on the roof. Mrs. Baker, who occupies rooms in the front part of the house in the second story, and Mrs. Whittaker were standing near the window when the meteorite fell, and heard the sharp concussion when it struck the roof. Mrs. Baker immediately picked up the meteorite as it lay near her on the roof, but dropped it again, finding it too hot to retain in her hand.

"The meteorite is a plano-convex specimen, about $1\frac{1}{2}$ inches in diameter, and about $\frac{1}{4}$ of an inch in thickness. The outside or convex surface possesses the usual crusted appearance, while the inside or plane surface differs from



FRINGED DRAGON AND FLYING DRAGON.

ordinary meteorites in possessing the appearance of sulphuret of iron, subjected to some degree of heat, instead of nickeliferous iron. One might easily infer that the meteorite was scaled off from a large bolide that passed over the city at that time. As it fell in the city, I have named it the Kansas City meteorite. It has not been subjected to chemical analysis."

Growth of the Earth.

"Since meteoric matter is continually falling upon the earth, she must of course be growing larger, and the daily number of meteors is so immense that it would be natural to suppose that the increase might be quite appreciable in a few centuries. It is not so, however: the surface of the earth is so enormous, compared with the quantity of meteoric matter, that, even on the most favorable hypotheses, her diameter would grow only about an inch in five hundred million years by accessions of this kind. A few figures will make this clear.

"As to the number of visible meteors, there is substantial agreement among authorities. The estimate of Professor Newton is as large as that of any one, I believe, and he puts it at 7,500,000 per diem, which number we will use. As to their average weight there is more difference of opinion. Probably, however, the most careful and best founded investigation is that of Professor Harkness, published in his report upon observations of the November meteors of 1866; and his conclusion is that 'the mass of ordinary shooting stars does not differ greatly from one grain.' Professor Newcomb appears also to concur in this estimate. There are reasons, which it would take too long to discuss, for thinking that this value is likely to be somewhat too small; but on the other hand it is almost absolutely certain that the average mass cannot be as great as one fourth of an ounce. To be on the safe side, we will assume 100 grains as the mean weight of the visible shooting stars.

"Remembering that the pound is 7,000 grains, we shall then find nearly 107,000 pounds, or about 50 tons, for the total weight of one day's supply of shooting stars. An allowance must also be made for the meteors too small to be visible (which are known by telescopic observations to be very numerous), and for the matter brought down by aerolites. If we double the quantity stated above we shall certainly be abundantly liberal, and this will give us 214,000 lbs. a day, or about 78,164,000 lbs. per year, as the earth's rate of growth in weight.

"Her increase of bulk depends upon the density of the meteoric matter, and probably this density does not differ much from that of ordinary soil, or nearly three times that of water. If so, each cubic foot would weigh about $187\frac{1}{2}$ lbs., and the annual meteoric accession to the bulk of the earth would be not far from 417,000 cubic feet. A cube about 75 feet on each side would be a little larger. It would take more than four millions such to make a pile as large as Mount Washington. Now, since the surface of the earth is about 5,484 millions of millions of square feet, it follows that the annual supply of meteoric matter, if spread uniformly, would form a layer whose thickness would be only $\frac{1}{111,111,111}$ of an inch. In other words, even on such extravagantly favorable hypotheses as we have assumed, the formation of a sheet of meteoric matter covering the earth to a depth of 1 inch would require a period of eleven hundred millions of years.

"If we suppose meteoric matter to have been just as abundant in space as now, since the beginning of time, and that the velocity of the earth's orbital motion has remained unchanged, and that the effects of her atmosphere and of her gradual shrinkage under the action of gravity can be neglected, then it can be shown by an easy course of reasoning, which would, however, hardly suit these columns, that her diameter must have grown during her whole existence at the same uniform rate as now, and we find that to build her up to her present dimensions by such a process of aggregation must have taken a period of at least twenty-seven and a half millions of millions of years.

"It is not intended to assert, however, that the earth was really formed in this way; and even if it was, the above estimate is of little value except as indicating the order of magnitude involved; since there is no certainty whatever—not even a probability—that in the early stages of the formation of the planetary system circumstances nearly enough resembled the present to warrant any conclusion. Nor must it be forgotten that the more probable estimates of Harkness and others as to the weight of meteors would lengthen all the periods of time mentioned from ten to one hundred fold. We have given the smallest values possible."—Professor C. A. Young, in *Boston Journal of Chemistry*.

A Severe Hurricane.

A cyclone of remarkable severity passed over the Central American states during October. The town of Managua, in Nicaragua, was inundated; four hundred houses were blown down, and damaged to the amount of \$2,000,000. In Blewfield, on the Mosquito coast, three hundred houses were destroyed, and the coffee crops over an immense district were utterly ruined. Twenty lives were lost, and several vessels on Lake Nicaragua were sunk by the disaster. The total damage is estimated at an amount of over five million dollars.

HYDROSTATIC APPARATUS.

The hydrostatic or hydraulic press is a machine in which the pressure of a piston, on a body of water of relatively small sectional area, is made to propagate the force to a cylinder of multiple area, where the force is directly and the speed inversely as the difference. We extract from Knight's "Mechanical Dictionary" the annexed engravings of a large variety of apparatus based on the same principles. A

HYDROSTATIC PRESS PUMP

is represented at A, in Fig. 1. *q* is the water cistern, and *r* is the pump barrel, which has a sucking tube, *t*, and a conical valve, *s*. The plunger is operated by the lever, which may be adjusted so as to give greater or less rapidity of stroke. *k* is a safety valve, and *z* the discharge valve. On lifting the plunger, water is drawn into the barrel, *r*, through the tube, *t*, and by depressing it the water is forced out through the pipe, *j*, the valve, *z*, rising to permit its passage. B, same engraving, is an

HYDRAULIC INDICATOR

or gage, used to indicate hydraulic pressure. Water, under the pressure to be tested, is admitted through the pipe, *a*, to a cylinder inclosing a piston, which tends to depress the short arm of the lever, *b*, counterbalanced by the weight, *c*. A movable weight slides on the long arm of the lever, and weights, *d*, are added to its outer end when a very great pressure is to be measured. An

HYDRAULIC PULLING JACK

is represented at C. A cylinder, *a*, contains a tube, *b*, to which the piston, *c*, is attached. *d* is a smaller tube sliding within the piston and tube, *b*. A valve, *e*, closes the communication between the cistern, *f*, which contains a pump, *f'*, operated by the hand lever, *h*, and the cylinder, *a*. Two passages, *g g*, afford communication between the tube, *d*, and cylinder, *a*, at the back of the piston, *c*. Water is poured into the cistern, and the jack is suspended, cistern end downward. Working the hand lever forces, by means of the plunger, *h*, water through the tube, *d*, and passages, *i i*, and depresses the piston to the bottom of the cylinder, *a*. The water at the back of the piston returns at the same time to the cistern through the passages, *g*. On unscrewing the stop valve, *e*, the water returns through the tube and passages, *i i*, to the cistern, relieving the piston from pressure and allowing a suspended weight to fall. D is a

BOOK PRESS.

It is arranged with either one or two pumps for forcing water into the lifting cylinder, the piston of which raises the platform on which the printed sheets are placed. This is kept in horizontal position by upright standards, and between it and the head of the press the sheets are compressed. At E and F are shown a

HYDRAULIC RAIL BENDER AND SHAFT STRAIGHTENER.

In the first of these, the action of the lever, *a*, operates a small force pump within the casing, which is connected with a larger cylinder. The piston of which forces the plunger against the rail, midway between the points where it is held by the lips, *c c*. In the shaft straightener, F, the beam, *a*, and shaft, *b*, are each inserted within the collars, *c*, and pressure is applied through the plunger, *d*, operated by a small hydraulic press, inclosed within the casing, *e*, and worked by the lever, *f*. G is an

HYDRAULIC PUNCH,

which comprises a force pump and operating cylinder, in which the piston carrying the punch, *b*, is inserted, inclosed in a case, *a*. The lever, *c*, operates the pump to depress the piston and to force the punch through a plate beneath; it is then raised by the lever, *d*, to punch another hole. H is a

JUICE PRESS,

used for the extraction of liquids from the more solid saturated portions. In this a horizontal plunger, *a*, actuated by a screw, *b*, works in a water chamber, *c d*, to raise a ram, *e*. A vertical screw, *f*, works in the head, *g*, on the standards, for raising or depressing the piston, between which and the ram, *e*, substances are compressed. I is the

HYDROSTATIC BELLOWS.

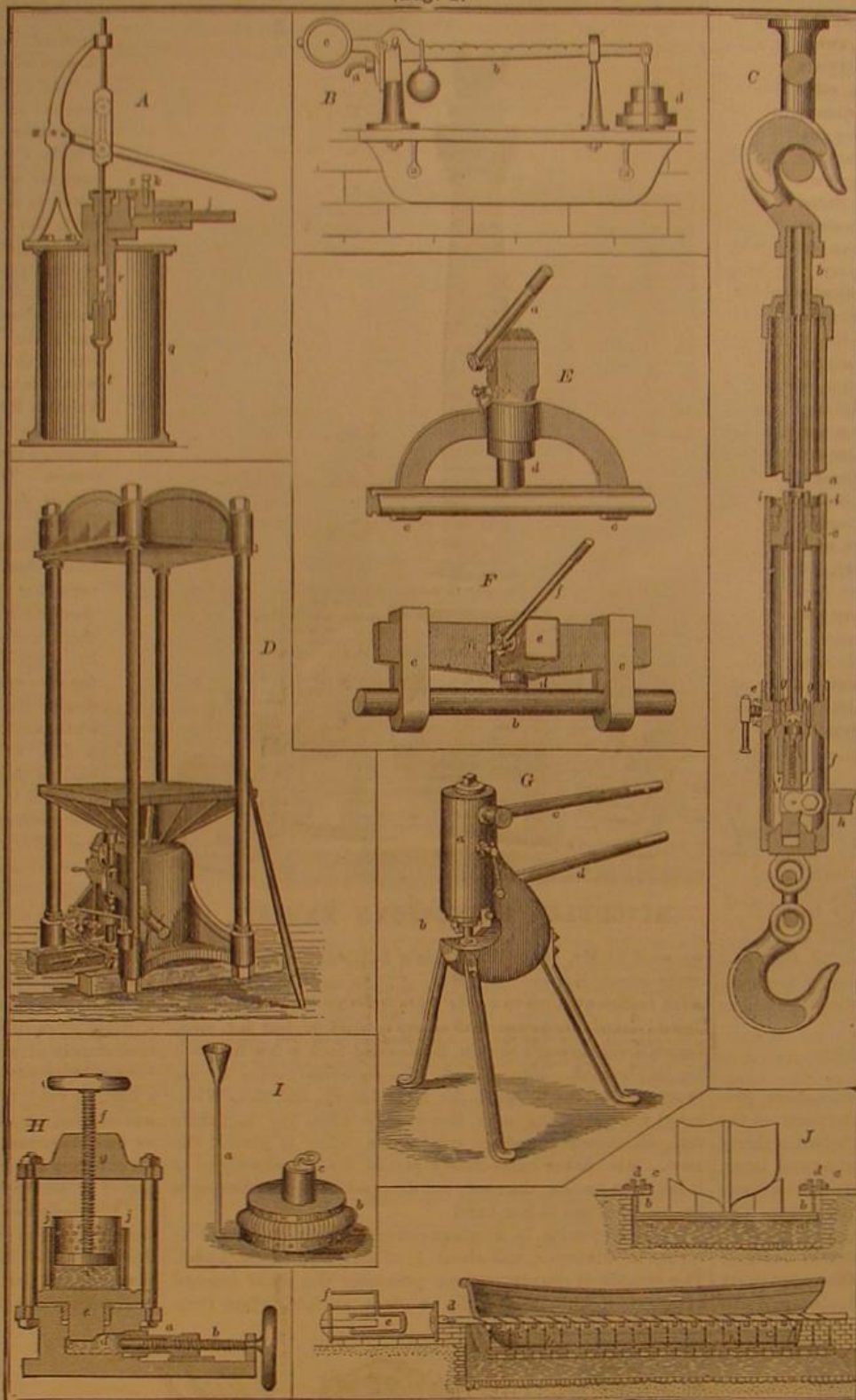
Water poured into the funnel-mouthed tube, *a*, flows into the flexible-sided box, *b*, and raises a weight many times greater than its own. The weight may be lifted in this way until its combined pressure and that of the column of water in the bellows, *b*, is equal to that of a column of water having an equal surface and

as high as the column in the tube, *c*. At J is represented a

HYDRAULIC DOCK,

by which a vessel is raised clear of the water for examination or repairs. The vessel is brought over a platform which is slung between the frames, being suspended by chains which pass over pulleys. The lower ends of the chains are

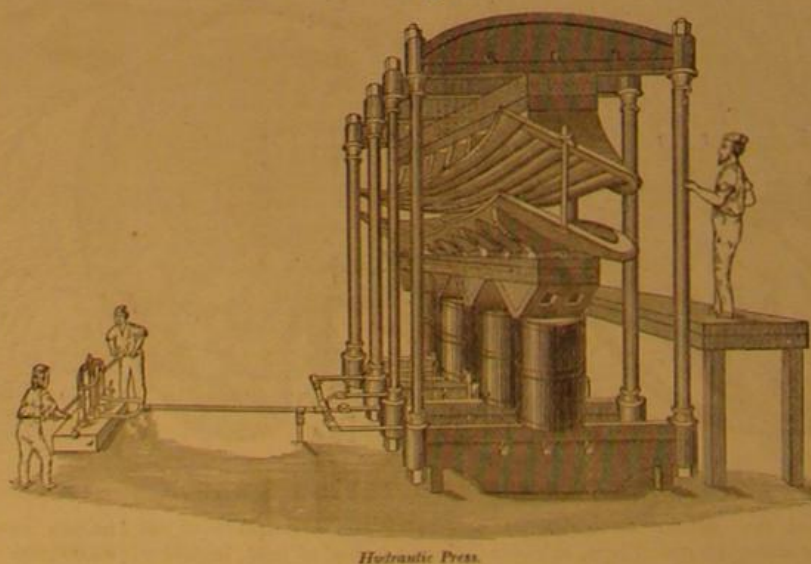
Fig. 1.



HYDROSTATIC PRESSES

attached to the platform, and they are fastened above to a horizontal wooden beam which communicates with the ram of an hydraulic engine. When the ram, which is placed in horizontal position, is moved, by the injector of water into the cast iron cylinder in which it works, the motion is communicated to the horizontal beam, and thence by the chains

Fig. 2.



Hydraulic Press.

to the platform, so that the vessel is thus slowly raised. The engravings give both a longitudinal and an end view of the apparatus.

Another application of the hydraulic press is illustrated in Fig. 2. Here it is used in making metallic life boats in

which one half of the boat is swaged at a time between dies. The engraving shows the disposition of the press clearly and needs no further description.

Who Originated Electroplating?

In our recent obituary notice of Mr. Thomas Fearn, which we extracted from the Birmingham (England) Gazette, it was stated that he was the probable inventor of the electroplating process, the patent of which he sold to the Messrs. Elkington. Mr. T. Spencer writes to the British Trade Journal to deny this and to claim the invention for himself. He says:

"Those who wish to see the first electroplated article—as I suppose it to be—may have their curiosity gratified in the Liverpool Museum, in which there is an electroplated teaspoon with my initials engraved on it, and the date, May, 1838. This date, be it observed, is above two years in advance of that of the Elkingtons' patent. This spoon, though it was not in the legal sense sold, was thickly covered with silver, and given to my friend, Mr. Joseph Mayer, the eminent silversmith of Liverpool, on the day, as it happened, the date was engraved on it. Its history is briefly this: During my electro experiments, Mr. Mayer had frequently seen their results in copper, and naturally became desirous to know how far the art was applicable to the deposition of silver. So for this purpose he sent to me, at my request, a white metal teaspoon, and with it a flattened out Mexican dollar to act as the opposing plate in the small galvanic arrangement I had then in use. Some fortnight after I took it to him, thickly coated with silver, but rough as it came from the trough. I remember it was weighed and found to be about $\frac{1}{4}$ oz. heavier than when it was received. The object in putting so much silver on was to test the adhesion of the one metal to the other.

"I suggested that the better mode of arriving at this would be to cut into it deeply with a graver, which Mr. Mayer had done accordingly, and on calling on him a few days after I was told it had stood the test I suggested. I then saw that he had got his engraver to put my initials on it, with the date."

Germination at Low Temperatures.

It has recently been discovered that seeds will germinate even if placed between blocks of ice. M. Haberlandt has conducted further investigations into this subject, and has kept a large number of different kinds of seeds at a temperature of 45°. In 23 days 8 species out of 23 showed distinct signs of germination, while others remained sterile to the end. M. Haberlandt plausibly conjectures that those grains of any given species which will germinate at a lower temperature than others will require a less amount of heat for their perfect development; and thus by artificial sowing, a variety might perchance be obtained precocious in habit and needing little heat.

Chinese Immigration.

Last April the Senate of California appointed a commission to ascertain the condition of the Chinese in that State and the social, moral, and political effects of Chinese immigration. The commission began to take testimony in San Francisco, April 11, and in 15 days examined more than twenty Chinese and an equal number of whites. The examination related to marriage, the use of opium, labor contracts, the character and power of the Chinese companies, the condition of women, Chinese intelligence, their purpose in coming, the effect of such immigration in other countries, and the political consequences here, as well as the moral, social, and religious bearing of their presence. The evidence is almost unanimous that all who come are imported by Chinese companies; are the lowest of their race; aim only to earn five or six hundred dollars; are secretly banded; regard no oath or law they dislike; introduce incurable diseases; corrupt American youth; refuse to accept American education, and therefore can never be fitted for citizens. The testimony is long, and there is much repetition, but it substantiates the charges made against the Mongolians; and now that labor is such a drug that more or less which is desirable on every ground is returning to Europe, and European immigration is prevented, there is a stronger probability that whatever can be done will be, and earnest measures adopted to prevent the further influx of a population foreign to every interest as well as to every prejudice of the country.—Bulletin of the Iron and Steel Association.

Recent American and Foreign Patents.

NEW MISCELLANEOUS INVENTIONS.

COMBINATION LAP RING.

George W. Atkins and James C. Harris, Noble's Lake, Ark.—This lap ring is formed of two parts, each of which has an opening at one side. The parts are secured together by rivets working in slots, so that one part may be slid or adjusted on the other. When they are adjusted in one position, the opening in the respective parts coincide; but when adjusted in another position, the openings do not coincide, and hence the ring is closed or becomes entire. This adjustment adapts the ring to be readily attached to or detached from chain links and singletree or double-tree hooks, etc.

IMPROVED WHIP.

Dexter Avery, Westfield, Mass.—The object here is to strengthen the whip at the joint, between the handle and stock, without increasing the cost of construction. The invention consists in a handle counterbored from its forward end to receive the end of the stock, and provided with a spike passing longitudinally through it from its lower end, and driven into the stock within said counterbore.

IMPROVED TRUSS.

Winfield A. Turner, Hiawatha, Kan., assignor to himself and J. F. Roehm, same place.—This is a pad made of a ball and adjustable socket tube, the pressure on the ball being regulated by a spring and set screw. The ball socket slides on a fixed socket of the base plate, and is secured by small set screws. A belt and thigh strap secure the truss in position on the body.

IMPROVED TRACE FASTENER.

Ephraim N. Banks, Wilkesbarre, Pa.—This consists of a socket having a deep ring groove formed around its outer end, and a notch formed in it at the side of said groove. There is also a hook having a circular head which fits into the groove of the socket. The hook can only be attached and detached by pressing the free end of a spring close against its side, to become detached accidentally.

IMPROVED PARLOR SKATE.

William Lockwood, Danville, Mo.—This relates to spring brakes for parlor skates, an attachment which has been heretofore used so as to bring the brake to bear upon the front wheel and connect it with a lever operated by the leg. The brake in the present case is a spring, from which a string extends down through a guide and up to the band of the operator, in such manner that the brake is forced down on the wheel by pulling up the string.

IMPROVED HOOF EXPANDER.

Charles H. Shepard, Elizabeth, N. J.—This has reference to an improved device for preventing and curing contraction of the hoofs of horses or mules, and consists of a V-shaped spring having inner opposite rings and projections, the whole secured by suitable devices to the interior of the hoof.

IMPROVED HARNESS SADDLE AND SADDLE TREE.

Samuel E. Tompkins, Sing Sing, N. Y.—The first invention consists of a rib formed on the ends of the tree plate to make a finish at the ends of the flap or top leather, the said rib being raised up in the construction of the plate. The upper surface of the leather is flush with the top of the rib, and is made in concave form to facilitate the finishing of it with a file and to furnish room for the back band. The second invention is a saddle-tree plate, having a bridge for the terret screw, constructed with jogs or shoulders only, or the same and a bar. These are connected at the upper side of the bridge to support the flap against downward strain. There is also a flap, made solid the entire breadth of the tree above the bridge, and having support against downward strain by shoulders.

IMPROVED BELLY PIPE NOZZLE FOR BLAST FURNACES.

Sigismund F. Vielhaber, Conshohocken, Pa.—This consists in a double walled nozzle made with a flaring inner end, and provided with a ring partition at the base of its flaring inner end, having two holes formed through it. Said apertures correspond with the holes in the outer end, in which the inlet and outlet pipes are inserted. There are two longitudinal partitions in the straight part, midway between the inlet and outlet pipes. There is a circulation of the water through the space in the flaring end of the nozzle, and said end causes the blast to enter the lower part of the furnace in every direction, so that there will be no dead places.

IMPROVED POCKET BOOK LOCK.

Ernst Schnopp, East New York, N. Y.—This lock may be opened and closed by direct pressure. It consists of fulcrumed and spring-acted jaw levers that are operated by a top plate, which has a conical lug, entering recesses of the jaw levers, so as to release the knob on the flap part of the lock.

IMPROVED TOY CARRIER.

John H. Adamson, Clifton, N. J.—This is a weighted carrier running by a pulley over a tight rope, and provided above the pulley and rope with a suitable spring clamping device, to which toy figures are attached.

IMPROVED SCALE BEAM.

Edward A. Rock, Ludlow, Vt.—In these weighing scales, the beam and weight stem are so constructed that no obstruction will be offered to the eye upon the sides of the beam to prevent the position of the indicator from being readily seen. The scale beam is slotted longitudinally to receive the stem of the weight, and there is a T indicator, the knife edges of the arms of which rest upon the notched upper edges of the beam.

IMPROVED SACK FILLER AND PACKER.

Edward M. Whitney, Batavia, N. Y.—This consists of a follower valve in the spout of a funnel, containing flour to be packed, which is made to rise up and let the flour descend into the sack, the mouth of which is attached to the funnel. The valve then closes over and presses down the desired quantity of flour into the sack, shutting the spout against the further escape of the flour while the filled sack is removed and an empty one put on. The contrivance is such that the quantity of flour can be varied at will for sacks of different sizes. The invention also comprises an adjustable platform for holding the bags when filling and pressing.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED DUMPING CAR.

Eugene Davis, Clinton, Ill.—This has reference to certain improvements in car-unloading apparatus in which a tilting track section is used in connection with a main track for running a car on and off said section. The invention consists in the combination, with a centrally pivoted track section, of a segmental rack bar engaging with a spur wheel on a driving shaft. By the arrangement of the rack bar below the axis of the tilting track section, the same can be depressed at either end by simply turning the operating gearing in opposite directions, thus dispensing with two sets of devices for tilting the track.

IMPROVED WINDOW BEAD FASTENER.

Hiram W. Stetson, Black Brook, N. Y.—This consists of a metallic fastening plate, having a key hole slot that is secured to a detachable strip or bead and connected to the window frame by a fixed screw. By tightening or loosening the fastening screws, the putting on or removing of the beads or strips is facilitated, while, at the same time, the reliable fastening of the beads to the window frame is obtained.

IMPROVED WOOD-PLANING MACHINE.

Andrew M. Mortimer, Salt Lake City, Utah Ter.—This machine has novel mechanism, which operates in such a way that a board, after being passed through the machine and being planed upon one side, may be raised, passed back, or returned through the machine and planed upon the other side.

IMPROVED DUMPING WAGON.

Francis M. Pennebaker and William F. Pennebaker, Pleasant Hill, Ky.—This consists of the combination, with the box contrived to slide back on the wagon bed and tilt down behind for dumping, of a windlass under the driver's seat, and cords so connected with the box that it can be run out and allowed to dump, and drawn back.

IMPROVED COMBINED STEP AND HUB BAND.

Robert McDonald, Georgetown, Col.—This is a step, hub band, nut, and dust box combined in a single casting or piece of metal, or made in several parts, permanently fixed together. It provides a step at the desirable point and answers the purpose of a nut and hub band.

IMPROVED SINGLETREE.

Louis Flatau, Pittsburg, Tex.—This singletree has near each end a circular groove, and thence, running to the end, a longitudinal groove. With this construction, the trace rings cannot become accidentally detached, and can only be taken off by slipping the link into the longitudinal groove, and then slipping the ring off.

NEW HOUSEHOLD INVENTIONS.

IMPROVED MIRROR.

Ludger T. Berton, Paris, France, assignor to Pierre Leopold Brot, of same place.—This is a compound mirror, formed of a main glass having a frame, within which are hinged, on opposite sides, two other glasses, to fold within said frame.

IMPROVED FOLDING CHAIR.

Frank F. Parker, Gardner, Mass.—This folding chair has arms extending from the back to the upper ends of the front legs, to which they are connected by links secured to the brace uniting the lower extremities of said arms.

IMPROVED DOOR CHECK.

William Cassill, Reed's Mills, O., assignor to himself and James M. Henderson, of same place.—As the door is swung open it strikes against and pushes back a bumper, the rearward movement of which throws a catch forward to grasp the edge of the door and hold it open until released by turning back the said catch.

NEW AGRICULTURAL INVENTIONS.

IMPROVED BARBED METALLIC FENCE.

William H. Gilman, Belvidere, Ill.—This consists of a bar of metal, either flat, flanged, or corrugated, pierced by a series of pairs of holes arranged on a line either at right angles with the bar or diagonally, and provided with pointed wire barbs fixed in the said holes.

IMPROVED WHEEL PLOW.

Edward T. Hunter, Hallsville, Ill.—This is an improved riding attachment for breaking plows, so constructed as to receive any desired kind of plow, to enable the plow to be placed between, or at one side of, the wheels, and may be adjusted to receive a left-hand or a right-hand plow, as may be desired.

IMPROVED CORN PLANTER.

Henry J. Snyder, Adams, Evansport P. O., O.—This machine combines several new mechanical devices which enable it to furrow, drop the seed, cover it, and mark the hills and rows, so that the field may be planted in perfect check row.

IMPROVED FRUIT PICKER.

John C. McEwen, Leesburg, Fla.—In this fruit picker a combination of wires is fastened to a disk, being free at their outer ends to admit the twigs between them. Shears are arranged so that the fruit is allowed to rest in the picker before the stem is excised.

IMPROVED CHECK ROWER.

William L. Black, Virginia, Ill.—This consists of a pair of forked levers attached to a supporting frame, and connected by rods with the seed valve bar of a corn planter. It is operated by a rope having knots or buttons at regular intervals, which passes around a sheave at each end of the supporting frame and through the forks of the levers, and is attached to stakes at each end of the field.

IMPROVED PLOW.

George T. Hedrick, Mill Springs, Ky.—The invention is an improvement in the class of sod or turning plows, and relates, first, to the construction of the stock whereby it is adapted for attachment of right and left shares and moldboards; second, to the construction of said shares and moldboards, whereby they are adapted for said attachment; third, to the employment of a detachable and adjustable L or T head brace for the share; and fourth, to the provision of an adjustable wheel which is so attached to the heel of the plow as to adapt it to be swung under the latter to support it while being drawn or propelled from one place or field to another.

IMPROVED HAY RAKER AND COCKER.

Moses Manlove, Muscoda, Wis.—The object is to collect the hay and deposit it upon the ground in cocks. To an endless moving belt are attached crossbars, which are provided with teeth inclined forward, and by which the hay is taken from the ground, carried up the said elevator to its upper end, and dropped into a box, formed in the rear end of the machine and made of such a size as to contain enough hay for a cock. When enough hay has been collected for a cock, a lever is raised, and the weight of the hay forces the bottom and the door of the box open, and leaves the cock stand upon the ground.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED RAILROAD CROSSING.

Darius Pierce, Tower Hill, Ill.—This is an improved crossing for railroad tracks, on which the main and guard rails may be changed to be worn out entirely on both sides, being rigidly secured in position on a suitable bed plate. The main and guard rails are secured at the ends by corner posts, applied by screw nuts to the bed plate. The concave base rail of the crossing is retained by the rail sections and the inner recessed corner posts.

IMPROVED CAR COUPLING.

Leonard Fleckenstein, Crosswell, Pa., assignor to himself and Martin Miller, of same place.—This relates to improvements in the automatic car coupling for which letters patent were granted to the same inventor, so that the working of the same is facilitated, it being adjusted for cars of different height, and always kept in the center to interlock perfectly square on curves. It is an arrangement of spring hooks which couple readily when hung to the required height, and are applied to the car frame by a swinging plate and cushioned bar with the same degree of flexibility and adjustability as the common drawbars in general use.

IMPROVED COTTON AND HAY PRESS.

William M. Penniston and William H. Penniston, Fox, Mo.—This includes a lever presser, in combination with one side of the pressing case, to press the hoops against the side of the bale to hold them in position while they are secured on the other side; another lever presser, on the other side, to hold the hoops at one end while they are strained and fastened; and a lever contrivance for straining and holding the hooks for securing them.

IMPROVED GOVERNOR FOR STEAM ENGINES.

Robert W. Gardner, Quincy, Ill.—This invention consists of pendulous arms, with inner extension toes, acting on double-link parallelograms connected to the valve rod and regulated by a top set-screw bearing on a top stud of the links. The valve chamber has two steam passages and two disks that are detachably applied to the valve rod, to obtain a uniform flow of steam, the valve rod being guided below the steam passages.

IMPROVED STOP WATCH.

Henri A. Lugin, New York city.—This consists in a wedge-shaped lever and spring, arranged so that it will, when used, raise the center beveled wheel, and so, throwing it out of gear, will interrupt the connection with the watch train and stop the quarter second and split the quarter-second hands. When the lever is brought back to its former position, the beveled center wheel, with the aid of a small spring, attached to it and pressing against the bridge, is made to gear again with the other beveled wheel, and so with the train of the watch.

IMPROVED FEED WATER HEATER.

John B. Mitten, Peru, Ind.—This consists of a series of chambers formed by longitudinal and lateral partition walls, of which the lateral walls have central openings, so that the water is compelled to pass from one longitudinal series of chambers to the next adjoining one, and so on to the boiler. Bottom plugs of each chamber serve for the purpose of cleaning out the impurities collected on the bottom of the chambers, the water being thus heated and purified in its passage from pump to boiler.

IMPROVED BUNG MACHINE.

Charles Abel, Brooklyn, N. Y.—This is an improved machine for forming bungs with tapering sides and beveled heads, from wooden cylinders of the proper length. In using the machine a bung blank is placed in the holder, which is then moved forward by a cam, bringing the blank between centers. A sliding center is then forced forward, and the holder is drawn back. Cutters are now operated to taper and bevel the bung, and then, with the center, are drawn back by springs, and the complete bung drops. The holder then moves forward with another blank, and so on, the whole operation being automatic, except the single act of placing the blanks, one at a time, in the holder.

IMPROVED MACHINE FOR ROLLING NUT BLANK BARS.

Henry Johnson, Haverstraw, N. Y.—This is a pair of rolls, each one of which is made up of sections that are detachably fixed to the shaft. One section of each roll is conical, and forms the flat of the bar, and another section is chamfered out to receive the smaller end of the conical section, and has formed on its side the reverse of the form required in the edge of the rolled bar. By this arrangement the flat of the bar passes through the rolls at an angle with the axis of the rolls between a line parallel with the axis and a line running at right angles thereto.

IMPROVED SNOW PLOW.

Horace Resley, Cumberland, Md.—The improvements consist in the particular construction and arrangement of the scoop with respect to the supplemental plow for removing the crust of snow, in the means for adjusting the scoop, and in the arrangement of cutter blades at the points of the scoop where the divided columns of snow commence, to turn which, blades divide the columns into smaller parallel columns, which permits the more easy deflection of the same to one side.

IMPROVED RAILROAD SWITCH.

Conzac S. Bastright, Lebanon, N. H.—This switch is so constructed that the movable rails may be adjusted into the required position by the wheels of the advancing engine, so that there can be no running off the track from a misplaced switch.

IMPROVED WIND WHEEL.

John J. Kimball, Naperville, Ill.—This improved wind wheel has vertical fans pivoted at the ends in fixed horizontal arms of a vertical revolving shaft, so that they will turn edgewise to the wind, and the wheel will stand at rest. For holding them so as to take the wind sidewise, there is a stop bar extending along one side of each series from the outermost one to the center, where it is connected to a weighted cord hung around the shaft. This draws the bar, and stops the fans sidewise to the wind at one side of the wheel, while they are still free at the other side to turn edgewise, thus enabling the wind to take effect for revolving the wheel. A contrivance for lifting the weights, and thus freeing the fans to the wind on both sides of the wheel, is used for stopping it.

IMPROVED BLOWER.

John M. Cayce, Franklin, Tenn.—The object of the invention is particularly to furnish a blower which shall be capable of being operated with the least possible friction in which the use of valves or other appliances liable to get out of order, and which necessarily add considerably to the cost of the machine, are dispensed with, and which shall be adapted to automatically regulate the amount of air forced through it in a given time. To this end the patentee employs, first, a hollow rotary cylinder having perforated heads, and provided with a series of curved tubular arms attached to its periphery; and second, an air suction pipe, which forms the hollow axis of the wheel and extends upward within the chamber of the cylinder above the level of the water in which the latter revolves; and thirdly, an expandible, liquid seal air receiver which acts as a governor to regulate the speed of the blower.

IMPROVED CAR AXLE BOX.

Marion Jansen and Josiah Mekeel, Garrison's, N. Y.—The journal box has a door, closed by a spring key. The oil cup has a half-round groove formed upon the lower side of its bottom, to receive and rest upon the journal. In the bottom of the cup are formed a number of small holes, through which the oil escapes to the journal, and in which are placed pins to keep them clear, and facilitate the escape of the oil. To the front side of the cup is secured an open glass tube, the lower end of which is connected with a hole in the cup, so that it can be seen, by simply opening the door, how much oil there may be in the cup.

Business and Personal,

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Trade Secrets—Valuable Recipes—Most Valuable Information for all Mechanics and Engineers. See "Wrinkles and Recipes," 250 pages. Splendidly illustrated. \$1.50, post paid. H. N. Munn, Publisher, 37 Park Row, New York City.

Agricultural Implements and Industrial Machinery for Export and Domestic Use. R. H. Allen & Co., N. Y.

Town and Village Hand Fire Engines, with hose carriage and fittings, only \$350. Send for cuts and full information. S. C. Forsyth & Co., Manchester, N. H.

Wanted—To correspond with Manufacturers of small articles, cast or malleable iron. Clamp and Treadle, my improvements on Animal Trap. Patent granted August 1, 1876. Would sell some territory. Give price per lb. Homer S. Davis, Camp Brown, Sweetwater Co., Wyoming Territory.

D'Heureuse's Grain Process—Mashing quickened and perfected under pressure in brewing, distilling, preparing food for man and beast, &c., &c. Immense savings. Responsible agents wanted for Canada and U. S. R. d'Heureuse, New York P. O. Box 395.

Journal of Microscopy—For Amateurs. Plain, practical, reliable. 50 cents per year. Specimens free. Address Box 473, New York.

For Sale—Shop Rights to every Tool Builder for Bean's Patent Friction Pulley Countershaft. D. Friebe & Co., New Haven, Conn.

Scroll Saw Patterns.—Send 3c. stamp for illus. Catalogue—300 designs. L. H. Russell, Stratford, Conn.

For Sale, Cheap—Centennial Shafting.—In Machinery Hall: 3 complete lines, each 624 ft. long; 1 line 162 ft. In Pump Annex, 1 line 191 ft. In Machine Shop, 1 line 112 ft. In Agricultural Hall, 4 lines, each 182 ft.; 2 Driving Counter Lines. All Cold Rolled. For full specifications and price, apply to Jones & Laughlin, Pittsburgh, Pa.

Picture-Frame Machine—Foot or Power. Makes 5 frames easier and better than 1 by old way. New thing. \$80 to \$125. E. L. Eastman & Co., Washington, D. C.

Superior Lace Leather, all Sizes, Cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Army, 148 North 3d St., Philadelphia, Pa.

For Sale—State Rights of Patent Safety Horse Hoopless, sells on sight. Address, for terms, circulars, etc., J. F. Riesgraf, care of Box 773, New York City.

Wanted—Responsible agents or purchasers of rights for Canada patent "d'Heureuse's Grain Process." Unground corn mashed in one hour, yield of spirits increased to 18 and 20 quarts per bushel. R. d'Heureuse, New York P. O. Box 395.

Magic Lanterns, Stereopticons, for Parlor Entertainment and Public Exhibitions. Pays well on small capital. 74 Page Catalogue free. Centennial Medal and Diploma awarded. McAllister, 49 Nassau St., N. Y.

Noiseless Exhaust Nozzles for Exhaust Pipes and Pop Valves. T. Shaw, 915 Ridge Av., Phila., Pa.

Shop Stoves—Brazil Foundry, Brazil, Indiana.

Boiler Punch, 6 Lathes, 9 ft. Planer, Brooks & Winbrenner, 261 North 3d St., Philadelphia, Pa.

Fire Hose, Rubber Lined Linen, also Cotton, finest quality. Eureka Fire Hose Co., 13 Barclay St., New York.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocom & Son, Drinker St., below 147 North Second St., Philadelphia, Pa.

The Scientific American Supplement—Any desired back number can be had for 10 cents, at this office, or almost any news store.

500 new and second hand machines at low prices, fully described in printed lists. Send stamp, stating just what you want. S. C. Forsyth & Co., Manchester, N. H.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., 80, Newmarket, N. H.

Water, Gas, and Steam Pipe, Wrought Iron. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

For Solid Wrought-Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 259 W. 7th St., N. Y.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water Street, New York.

Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability, are cheaper by comparison than any others extant. 246 Grand St., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

See Bault's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 5-25. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

More than Ten Thousand Crank Shafts made by Chester Steel Castings Co., now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 317.

Power & Foot Presses & all Fruit-Can Tools. For catalogue Wm., Bridgeton, N. J. & C. 27, Mch'y. Hall, Cent'l.

The "Abbe" Bolt Forging Machines and the "Palmer" Power Hammers a specialty. Send for reduced price lists. S. C. Forsyth & Co., Manchester, N. H.

Steel Castings, from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon, 470 Grand Street, New York.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Shingle, Heading and Slave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

"Dead Stroke" Power Hammers—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 20 per cent. Hull & Beiden Co., Danbury, Ct.

Notes & Queries

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Enquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical enquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to enclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to enclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

W. H. L. will find descriptions of steam canal boats on pp. 15, 246, vol. 27, and on p. 350, vol. 36.—R. K. will find directions for galvanizing cast iron on p. 346, vol. 31.—J. T. will find directions for renovating worn files on p. 361, vol. 31.—W. D. M. will find a description of a hydrogen lamp on p. 242, vol. 31.—G. S. will find directions for dissolving rubber on p. 119, vol. 28.—R. L. W. will find directions for making rubber stamps on p. 155, vol. 31.—A. D. will find directions for making farina (dextrin) from potatoes on p. 315, vol. 30.—J. C. W. will find directions for cleaning shells on p. 122, vol. 27.—L. W., Jr., will find directions for engraving on glass on p. 375, vol. 33.—C. A. H. will find directions for dyeing felt hats black on p. 101, vol. 30.—A. C. will find an explanation of the ball and current of air puzzle on p. 262, vol. 35.—J. W. C. will find directions for condensing milk on p. 343, vol. 30.—M. G. will find directions for drilling glass on p. 218, vol. 31.—W. H. will find the article on the penetrating power of light on p. 180, vol. 33.—F. S. will find a description of infusorial earth on p. 296, vol. 35.—J. McG. will find directions for preserving cider on p. 11, vol. 31.—E. A. D. will find directions for making a magnet helix on p. 230, vol. 35.—F. B. will find directions for utilizing sawdust on p. 276, vol. 32.—H. E. will find a description of the templet odontograph on p. 181, vol. 35.—W. H. D. will find directions for painting theatrical scenery on p. 200, vol. 26.—R. should use black Japan varnish for lettering on marble.—G. S. should consult a dentist.—W. T. B. will find directions for making hard soap on pp. 331, 379, vol. 31. For toilet soaps, see p. 286, vol. 28.—C. F. S. will find directions for purifying cistern water on p. 365, vol. 32.—F. B. will find that the best way to put bronze on paper is to draw the design in gold size, and dust on the bronze.—A. D. will find a good recipe for a white metal on p. 139, vol. 31.—W. J. E., M. F. B., F. N. P., W. G., W. F. H., R. J. B., G. S., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) D. Z. asks: How can I separate chloride of silver from sand? A. Dissolve in ammonia water, and reprecipitate the solution by the addition of an acid, or evaporate to dryness.

(2) M. G. says: I have about 35 gallons of Rhine wine which seems about to sour. How can I reclaim it? A. Heat a test portion to near the boiling point, add a little carbonate of iron, agitate briskly for a few moments, and filter. If this does not succeed, try a small quantity of lime water. Let us know how these succeed. Foul or sour wines are usually corrected by digestion with a little chalk or the white carbonate obtained from calcined oyster shells, also by agitation and digestion with charcoal or boneblack, and subsequent filtration or decantation. Salicylic acid has lately been employed to cure the rancidity or foulness of wines, and to check fermentation. In Germany varying quantities of grape sugar is added to some wines. 2. Do wines and liquors draw any copper from brass faucets? A. Many wines do exert a more or less solvent action upon copper, owing to the free acids which they contain. 3. How is H₂S most conveniently prepared? A. It is obtained by the action of diluted sulphuric acid on monosulphide of iron. The gas is ordinarily dissolved in cold distilled water as it comes over.

What fulminate is used in pistol cartridges, and how is it put in? A. We believe the mercury fulminate is generally employed. Percussion mix-

tures, of chlorate of potash, sulphide of antimony, sulphur, and gunpowder, and chlorate of potash and amorphous phosphorus, are used to a limited extent.

(3) D. W. asks: How many lbs. pressure will it require to break a cast iron beam in the center supported at each end? The beam is 36 inches long, 13 inches deep, and 1 inch thick. A. About 100,000 lbs.

(4) C. E. E. says: I have a pleasure boat propelled by an engine 6 inches in diameter by 6 inches stroke, which makes 200 revolutions per minute, using steam at 100 lbs. pressure in the boiler, cut off at one half stroke. I wish to attach a surface condenser to it; please inform me of what size it should be, etc.? A. Make the condenser with from $\frac{1}{2}$ to $\frac{3}{4}$ as much cooling surface as your boiler has heating surface. Use small tubes, quite thin, full particulars of which you can obtain from a manufacturer. If you only wish to condense the steam to use as feed water, you can discharge it into a pipe immersed in the water, and use a small air pump. By this arrangement, which is in use on several small steamers, you do not require a circulating pump.

(5) A. M. asks: If I have a cylinder of 2 inches bore, with an airtight piston in it, how much pressure do I get by compressing the air into any fractional part of the cylinder? A. If the temperature of the air is kept the same, the pressure varies inversely as the volume. For the case in which there is no gain or loss of heat, see answer No. 26, October 7, 1876.

(6) J. F. asks: How can I make a paste or paint for marking flour sacks? A. The aniline colors are perhaps the best materials you could use for the purpose. There are, of course, many other marking fluids that might give proper satisfaction as to application, durability, etc.; but they are all more or less difficult to extract from the fabric after application. The aniline colors may be removed completely and with facility by the addition to the washing water of a small percentage of spirit of wine or wood spirit.

(7) E. M. C. says: By what process can I soften plaster of Paris which fastens the brass burners to lamps? A. Use plenty of water and mechanical exertion.

(8) F. A. H. says: I have seen the idea advanced of lubricating sewing machines and other light machinery with glycerin. What do you think of it? A. It has been used, we believe, with very good results. Dilute it with water.

1. What is the difference between writing ink and writing fluid? A. In ordinary ink the iron salts and other ingredients are merely in mechanical mixture, being prevented from settling to the bottom by the addition of gums, etc. In the writing fluids, so-called, the ingredients are all in true solution. 2. What is copying ink? A. Copying inks contain sugar; in other respects they differ but little from ordinary inks.

(9) A. M. asks: 1. How can faded silver-plated ware be restored? A. Have it replated. This is the cheapest and best method. 2. I have tried mercury dissolved in nitric acid, applied with a cotton rag; and though this solution gives a splendid appearance, yet it does not stick long. Is it hurtful to use spoons or forks thus silvered? A. The mercury is very poisonous.

(10) E. A. asks: Can you give your readers any more details concerning the recipe in your No. 17, vol. 30, for making compressed yeast? A. The precise mode of preparing this ferment is more or less a trade secret. Make the mash in the ordinary way, of 1 part of bruised barley malt with 3 parts of bruised rye, the mash being cooled with the fluid portion of the wash. Add sufficient yeast to start a brisk fermentation, gather the newly formed yeast as it rises to the surface, wash well with water, and place in a stout canvas bag under a press, by which means it may be obtained as a stiff clayey dough. It is better to mix the yeast with from 10 to 20 per cent of potato starch. Many of your questions you can best answer for yourself, by experiment.

(11) T. R. A. asks: 1. What substance is the worst conductor of heat? A. The poorest heat conductors are found among organic substances: feathers, cotton, wool, straw, bran, wood, etc. 2. How may it be formed into a paste, to be baked and glazed as pottery ware is done? A. This is impracticable.

(12) T. A. J. asks: How can I collect mercury after it has been dissolved with nitric acid and diluted with water? A. Precipitate the mercury as oxide by the addition in excess of a strong solution of caustic potash or soda (caustic alkali), decant the supernatant liquid, dry the precipitate, place it in an iron retort, the neck of which or its connection just dips below the surface of cold water in a suitable vessel, and heat the retort strongly over a good coal fire until the pure mercury is all distilled over. It is advisable to wash the precipitated oxide of mercury well with water before drying it, previously to placing it in the retort.

How can I make a good carbon battery that will be strong and cheap? A. Place a suitable porous cup of unglazed porcelain in a glass or earthenware jar, and surround it with a thick piece of zinc. Fill the outer jar to within about 2 inches of the top of the porous cup with water, to which add about 2 ozs. of strong oil of vitriol. Place the plate of carbon in the porous cell, and surround it with a solution made as follows: In a pint of water dissolve 1 oz. of bichromate of potash, and add to this 2 ozs. of strong oil of vitriol; allow to cool before using. If the end of a copper wire of any length be connected, one with the carbon and the other with the zinc, the current will run through it from the carbon end to the zinc.

(13) H. G. W. asks: Why is it that, if we make a small hole through a piece of paper and hold it up before the eye at a distance of about 1

inch, and pass a needle down over the hole on the side next to the eye, the light appears to be cut off from the bottom first? A. As the images of all objects are inverted in the eye, when any object goes down, the image in the eye goes up, and as the rays of light cross in passing through small holes, the going down on one side is equivalent to going up on the other.

(14) I. G. O. asks: What is the best method to extract the oil from belts that have got saturated therewith? A. Wash with soap and warm water.

(15) E. F. asks: What acid can I use to clean dirty, already used benzine, to fit it for use again? A. It is easiest purified by distillation.

(16) W. J. says: I notice that the connecting rods of most of the small American engines are connected with their straps by means of bolts and one key. What advantage is there in using these bolts? Is not the gib and key just as good? A. If a connecting rod strap is held to the rod by a gib and key, the brasses must meet at the joint so that the key can be driven tightly home, thus locking the strap. If the joint of the brasses is left open so that driving in the key will take up the wear without having to file off any of the face of the brasses at the joint, the key in no way acts to lock the strap at all. If the strap is locked to the strap by bolts, it is no matter whether the joint faces of the brasses are left open or not; the strap will always be held securely in position, and its wear will be considerably less. The bolts hold the straps more securely and enable us to keep the length of the rod as nearly correct as possible by putting the key at one end inside and at the other end outside of the brasses, as shown on p. 490, vol. 2, of the SCIENTIFIC AMERICAN SUPPLEMENT.

(17) S. L. S. says: Does the use of coal oil on a mechanic's oilstone harden or soften it? A. It hardens stones of most kinds.

(18) S. N. M. asks: Is there not an error in the numbers given on p. 185, vol. 35, under title of "New Arrangement of the Spectroscope?" A. We have addressed Professor Young on the subject, and his reply is as follows: "The numbers are both given wrong. Calculation assigns for the velocity of the sun's surface 1246 miles per second. My observed velocity deduced from spectroscopic observations was 142 miles. At Buffalo I gave the number as 136, but I had neglected to apply a correction for the latitude of the point on the sun's limb at which the observation was taken, and this made a little more difference than I expected."

(19) C. S. asks: What metal or combination of metals would be best suited to take a sharp cast? The metal commonly used to take casts from paper molds scorches the paper, and I want something that melts at a much less temperature. A. Try the following fusible alloy, which fuses below the boiling point of water, at 201° Fah: Two parts of bismuth, one of lead, and one of tin.

(20) B. M. R. asks: When two shadows are brought near to each other, why do they seem to protrude toward each other and touch? A. The edges of shadows are not sharp, and when they are brought near together the edges overlap and become visible. When single, they were not visible.

How does thunder turn milk sour? A. It is done by the electricity in the atmosphere, which will coagulate the albumen in the milk; and it renders the sensitized gelatin, used in the carbon photo process, insoluble.

Do the trees of Australia turn their leaves edgewise to the sun? A. There are some instances in which they do, but not generally. The native trees are all evergreens. Some shed their bark and not their leaves. There are in Australia plums with the stones on the outside. There does not appear to be any general law governing the growth of vegetation there.

What is the cause of equinoctial storms? A. Observations extending over a large number of years show that we have more storms when the sun crosses the equator than at any other time.

What people of ancient Greece spoke the language now called Greek? A. None.

(21) H. S. G. asks: Do you know of any acids or any process that will eat off common solder from a gold watch case? A. If the solder is what you say, strong nitric acid will remove it without injury to gold; but before you try the experiment, be sure that the watch case is of gold.

(22) C. A. W. says: I am building a rustic fence of cedar poles, keeping the bark on; but I find that after a time the bark begins to fall off, which of course disfigures it very much. Is there anything in the way of a varnish, etc., which would prevent this? A. The usual course is to remove the bark in the first place as neatly as possible, so as to preserve the smooth surface of the cedar intact. With a little care, this can still be done with your fence, and will save you further trouble in this respect.

(23) D. H. says: I am wearing a plaster with one zinc and one copper plate connected by a wire. Will the verdigris which is formed, the skin being in contact with the copper, produce injurious effects? A. Possibly not verdigris, but other copper salts may be formed that are as objectionable and injurious.

(24) A. F. T. asks: 1. How can I dispel the bad odor arising from a damp wall indoors? A. If the wall is now papered, the bad odor may arise from the decay of the paper and paste. Strip off the paper and wash out the paste, etc. 2. How could this wall be best repaired, so that wall paper would stick and would not become discolored? The dampness was caused by water escaping into the cellar, which has since been filled up with yel-

low clay, the dampness and bad odor only became apparent some five years after the filling in. A. Place vertical furring strips on the wall 12 inches apart, and lath and plaster it anew. 3. Could the dampness of the wall have been caused by grass growing alongside the wall on the outside? A. We think not. The dampness most probably comes up from the bottom of the wall by capillary attraction.

(25) A. C. asks: How can I make a steam siphon pump to raise water about 8 feet, using nothing but pipes and fittings? A. Such pumps, as ordinarily constructed, require nozzles of a peculiar form, and we scarcely think that you can accomplish the same object with common pipe fittings.

(26) H. & S. ask: 1. Do the journals of the crankshaft of an engine support the whole weight of the flywheel, or is it partly taken off by the centrifugal force? A. The whole weight of the wheel is in running balance. If it is unbalanced the centrifugal force will take off weight at one part of the stroke, and increase it at the other. 2. Our flywheel is 9 feet in diameter, with a rim 4 x 5 inches, which weighs 1,500 lbs. It is made in 12 segments, and bolted on 6 wooden arms 3 1/2 x 5 1/2 inches, made secure in a center by 12 bolts. Are we safe in running her at 100 revolutions? Size of engine is 10 x 20 inches, crank shaft 5 inches in diameter. A. Yes, if the wheel be well built.

(27) T. A. H. asks: What is diastase? A. During the germination of seeds, the starch undergoes a species of fermentation and is converted into a mixture of dextrin and sugar, in which state it is assimilated by the young shoots. This conversion is due to the action of the peculiar ferment termed diastase, which exists in all germinating seeds during the act of growth, being probably merely albumen or gluten in a peculiar stage of decomposition. An impure solution of diastase may be obtained readily from malt or freshly germinated barley by grinding it, moistening it with half its weight of warm water, allowing it to stand for a few minutes, and pressing out the liquid. Malt does not contain more than 5/100th of its weight of diastase. Diastase is not a commercial article.

(28) E. W. M. says: 1. Can you inform me through your valuable paper how an artesian well is sunk? A. Sometimes a drill like an auger is used. In rock, a drill is necessary. 2. Are drive pipes sunk in the same way as artesian wells? A. In the driven well, a tube is sunk as fast as the hole is bored. 3. How do you ascertain when you have struck water? A. The presence of water can be ascertained by sounding, or by the aid of a small pump. It is by no means certain that an artesian well can be struck in any locality simply by boring.

(29) A. W. G. asks: Can you tell me what will render horn transparent, or nearly so, and sufficiently soft to be cut with a knife? It must harden again when dry. A. Try muriatic acid.

(30) G. H. asks: 1. I wish to bring water from a spring 3,000 feet distant. There is a fall of 15 feet, and there will be a head of 2 feet where the water enters the pipe. What quantity per day would be conveyed through a pipe 1 inch in diameter, and to what height would the water be thrown at the lower end? A. The height to which the water will rise at the discharge end of the pipe will depend upon the velocity. According to Weisbach's formula, if the pipe is straight and smooth, you can raise the water about 14 feet for a discharge of 1/3 of a U. S. gallon per minute, or you can discharge about 2 1/4 gallons per minute at the lower level of the pipe. 2. Will iron gas pipe answer? A. Yes.

(31) J. E. D. asks: How high will water rise from a 1/2 inch or 3/4 inch jet if brought 1,500 feet in 1 inch pipe, with a fall of 18 feet? How many gallons per hour would flow through said jets? A. With a well shaped discharge jet, 1/4 inch in diameter, you can probably throw a stream from 10 to 12 feet high, and discharge about 60 U. S. gallons per hour.

(32) S. D. P. Jr. says: Is it a settled fact that our best turbines yield a greater percentage of power from the same amount of water than overshot wheels of the best construction, especially where the stream is variable? A. In the case of a variable stream, experiments seem to show that there is an advantage gained by using a good turbine. When the head and discharge are constant, the principal advantages of turbines over overshot wheels consist in less weight and greater velocity, so that less gearing is ordinarily required.

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

G. A. C.—It is fool's gold (sulphide of iron).—H. M.—The scales are common potash mica. They are mixed up with sand and a little felspar.—J. K., Cal.—It is sulphate of lime.—J. K., Texas.—It is soda.—C. E.—It is diorite.

COMMUNICATIONS RECEIVED.

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

On Steamships, Rigging, etc. By R. B. F.
On Naval Appointments. By C. J. W.
On Solar Phenomena. By C. T. G.
On an Intra-Mercurial Planet. By W. M. R.

Also inquiries and answers from the following:
T. D.—H. W.—J. B.—G. M.—G. H.—D. L.—W. B.—G. J. D.—R. A.—S. O.—N. S.—E. C. S. F. F.

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.

Hundreds of inquiries analogous to the following are sent: "Who buys rabbit, raccoon, and muskrat skins? Who sells velocipedes? Who sells street car locomotives? Who makes match machinery? Who sells distilling apparatus?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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October 10, 1876.

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A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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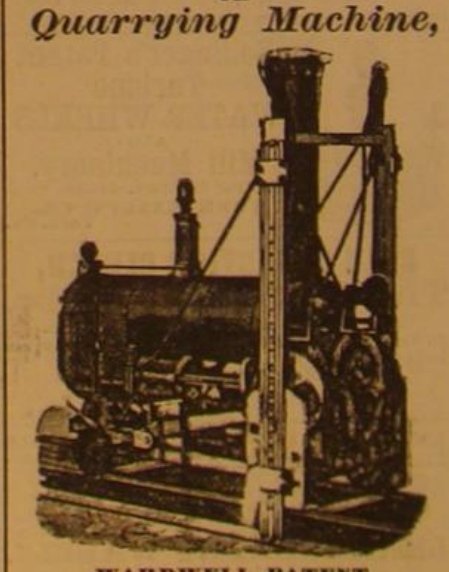
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