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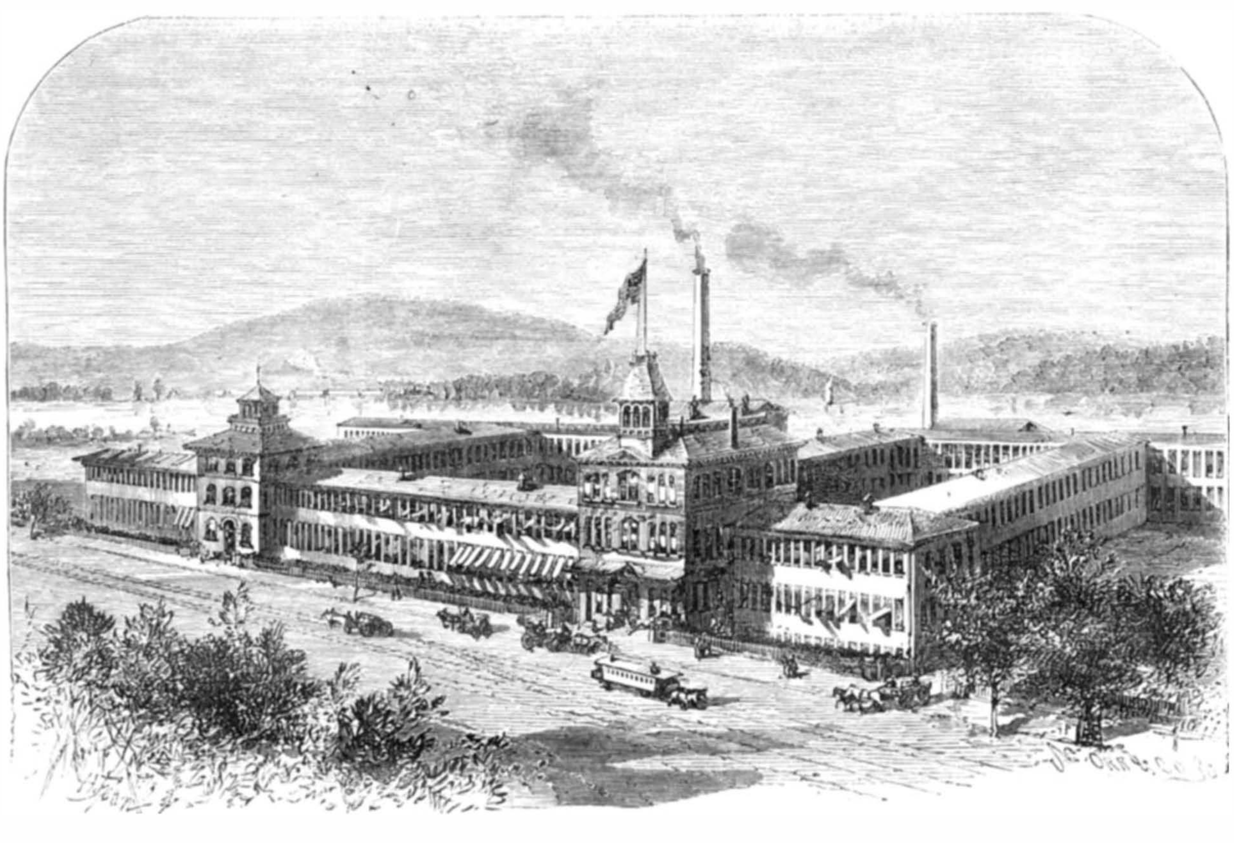
WATCHMAKING IN AMERICA.

THE WATCH AS A GROWTH OF INVENTION.

Watches made their appearance in Europe about the close of the fifteenth century, and, although our knowledge of their origin is very indefinite, yet they are commonly supposed to have been first made by Peter Hele, of Nuremberg, twenty-five years before the discovery of America. But they were not called *watches;* they were first named from their appearance, and known as *Nuremberg Animated Eggs.* There was almost a prophetic significance in this term, for the Nuremberg egg was the germ of a mechanism and of an industry which have been growing for four hundred years, and have reached their last and highest stage of development only in the present generation.

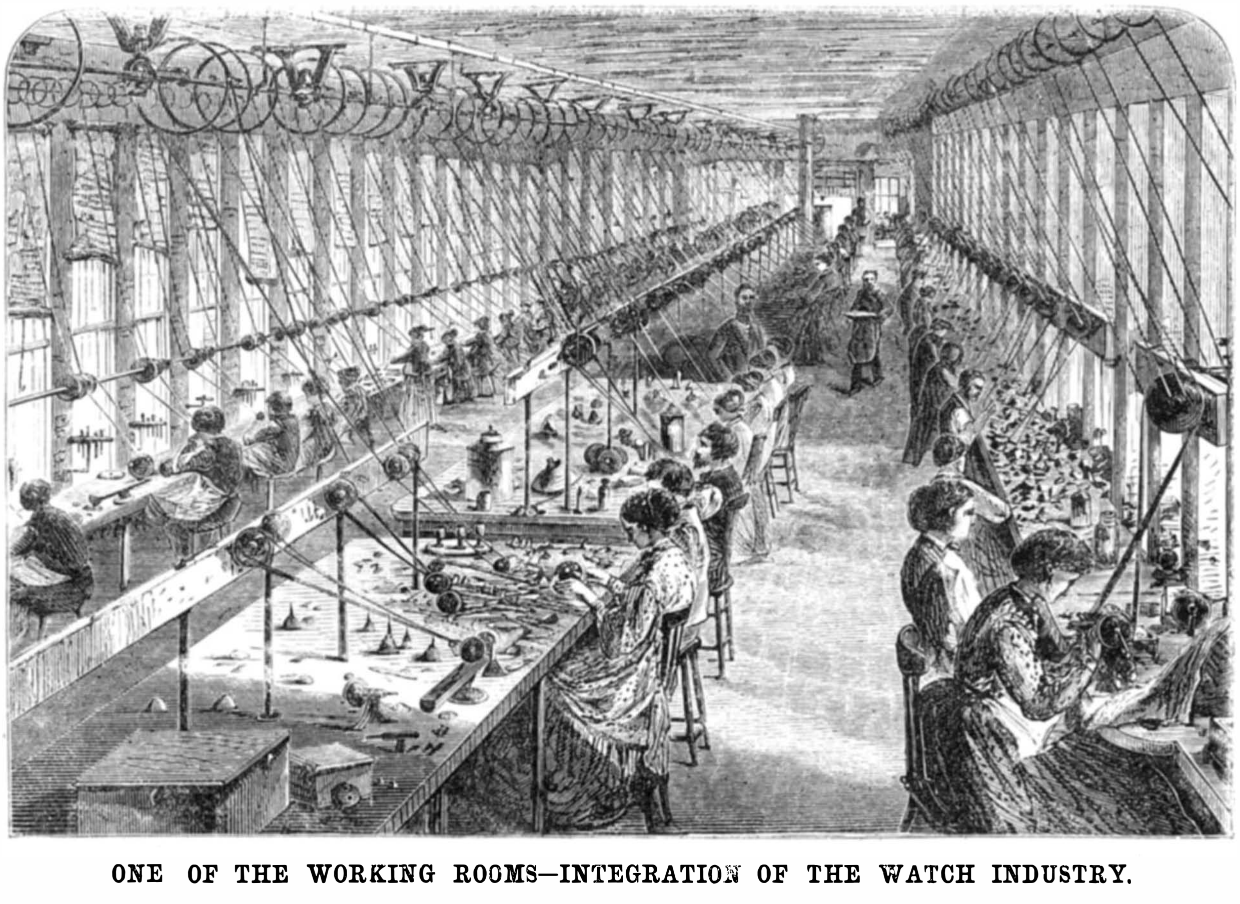
The advance in the art of measuring time may be taken as an index of the progress of man upon the earth. From that early period when time was rudely marked by the alternations of day and night, and the changes of the moon—when the year was vaguely divided into two seasons—cold and warm—which, as Hesiod tells us, were marked off by the coming and going of the birds, down to Professor Rood's recent and wonderful demonstration that the electric spark, which lasts but the twenty-five thousandth of a second, has nevertheless its history—its sequence of phenomena, the first stage of which lasts but the ten-millionth of a second—between these two distant terms of progress there has been a gradual growth of invention and construction, in relation to the arts of time-measurement, which may be taken as exemplifying the general law of advancing civilization.



VIEW OF THE WALTHAM FACTORY AT WALTHAM, MASS.

The accurate time-keeper was the indispensable predecessor of the locomotive and travel by railway. That it first made possible those rapid movements of multitudes over vast tracts of land and sea, by which people in these latter days have widened their experiences and attained a kind of terrestrial omnipresence, is sufficiently obvious. Yet this is but a small part of the advantages which exact time measurement confers upon modern society. The first condition of all systematic and concerted human action, of that economy of exertion which is necessary to the highest personal efficiency, and of that synchronism of movement which characterizes modern social life, is the correct indication of time. In the beginning this was not only impossible, but unnecessary. In the primitive state of man, when he had not yet learned to think with accuracy, or to guide his efforts by intelligence, or to combine his exertions with others, the indefinite chronometry of Nature was sufficient for his needs.

Time is measured by any regulated or regularly-recurring series of motions, which may be either natural or artificial. The conspicuous movements of Nature take place in cycles and measured intervals; in fact, all motion whatever is now regarded by the highest scientific minds as rhythmical. The impressive and rapidly-recurring round of changes which constitutes the *day*—the contrast of light and darkness, the sweep of the heavenly bodies across the sky, the recurrence of warmth and cold, and of sound and silence, served as the first natural markings of time. Accompanying this march of the grander phenomena of Nature there was also a chronometry of life—the vital periodicities of waking and sleep, activity and rest, hunger and satiety, the bursting forth and fall of foliage, the opening and closing of flowers, the migrations, cries, and habits of birds, beasts, and insects—all this intermittence of impressions at varying intervals served to give man his first conscious experience of succession, to develop in him the sense of time, and to divide it for his convenience.



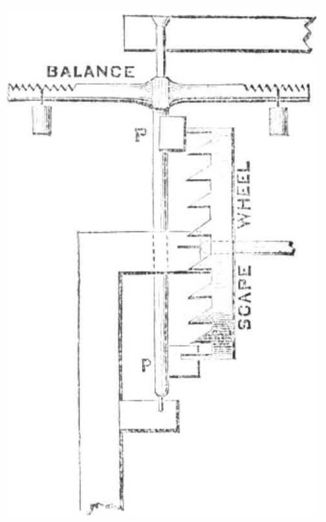
ONE OF THE WORKING ROOMS—INTEGRATION OF THE WATCH INDUSTRY.

But with the beginning of civilization it became necessary to measure time with more accuracy, and art undertook the task. The first artificial contrivances for the purpose were sun-dials, hour-glasses, and clepsydræ. With the sun-dial time was measured by the course of a shadow over a scale, and was therefore useless in the darkness of night and in cloudy weather. The hour-glass marked the time by the trickling of fine sand through a small opening between an upper and a lower glass chamber. The clepsydra attained the same result in a similar way by the flow of water. In its simplest form it consisted of an upright cylinder large enough to hold several gallons of water, and having a fine opening at the bottom through which it slowly flowed out. It was of course emptied in equal times, and being refilled the successive operations served to mark off the divisions of the day. The Assyrian monarch Sardanapalus is said to have had a timekeeper of this description in his palace at Nineveh, and there was one also in every ward of the city. These were filled at sunrise, and, as soon as they were emptied, at a signal given by a man posted upon a high tower, they were refilled, and a number of heralds sent forth proclaiming the fact through the town, that the inhabitants might regulate their transactions, and know when to eat, to worship, to labor, and to sleep. The intervals between the emptying and refilling, in this case, like the rounds of the patrolman, which were also anciently employed to measure time, were termed *watches.*

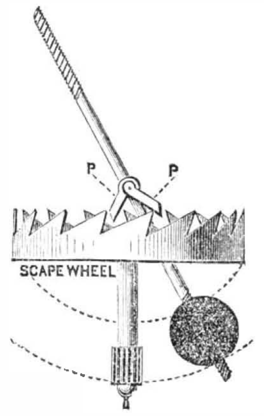
The flowing water was at length made to turn a wheel, which carried an index around a dial, and thus by the introduction of machinery the hours of the day and the motions of the heavenly bodies were indicated. The simple vessel with an orifice thus gradually grew into a complex mechanism known as the "water-clock." These contrivences came into extensive use in the East, and served as the measures of time for two thousand years.

Falling weights were substituted for falling water as the motors of clocks about the eleventh century, the first used being large machines set up in churches and monasteries. The oldest of which the actual construction is preserved, was made by Henry de Vick, a German, and set up in Paris for Charles V., of France, in 1379. It was a thirty-hour clock, with a weight and a train of wheels giving motion to one hand, and the striking part was precisely the same as that still used. The mechanical conception of De Vick's clock was quite similar to that of our modern timepieces. This principle is, that the impelling power stored up in a raised weight or bent spring shall then be communicated to a brain of wheels which are set revolving, and that the force or motion shall then be cut up into a succession of minute but equal impulses, which is done by converting a rotary into a vibrating motion. The last and quickest wheel of the train has its teeth so formed that they are alternately caught and escape, and hence the wheel is called the "scape wheel," and, from its resemblance to a crown, the "crown wheel." The bar, or staff, with its projections, which successively catch and release these teeth, is termed the "escapement," and it is through this that the rotary is converted into the backward and forward movement.

De Vick's old clock had all these parts in a crude form. The oscillating mechanism consisted of a horizontal lever with movable weights, so that the further out they were hung the slower would be the vibrations. This lever was hence called a "balance," and the term is still applied to the corresponding part of a watch, although the present watch balance might be more properly termed a fly-wheel. The escapement, as shown in the figure, consists of the axis of the balance, to which two projections are attached, called the "pallets," and fixed at such an angle to each other that, as one pallet moves out of the way of a tooth and lets the wheel go forward, the other moves into the space between two teeth, and stops the motion again. Of course, if there were no check, the weight would run down with an accelerated motion of the train; but, as a tooth of the scape-wheel catches one of the pallets, the movement of the train is arrested and spent in swinging the balance round until the tooth escapes. The train now starts again, but, as a tooth catches the other pallet, its motion is again stopped and expended in arresting the vibration of the balance, and in swinging it round in the opposite direction. Such was the construction of clocks for three hundred years, when they received their last grand improvement by converting the horizontal swing of the balance into the vertical swing of the pendulum. The accompanying figure shows how, by taking off one of the weights and hanging the balance in an upright position, it becomes a pendulum; and it is claimed by the English that Harris actually made this conversion and constructed the first pendulum clock for St. Paul's Church on this principle. However this may be, the world credits Galileo with the discovery of that law of the pendulum which made its introduction an epoch in horology, viz., that it swings through unequal arcs, or makes its long and short vibrations in equal times, which is termed its "isochronism." Galileo is said to have arrived at the principle by noting the vibration of a lamp suspended from the roof of a cathedral, and timing its movements by his pulse. High authorities, however, say that there is no such thing in Nature as *absolute* isochronism, though practically pendulums can be kept vibrating with no greater deviation from it than one vibration in half a million.



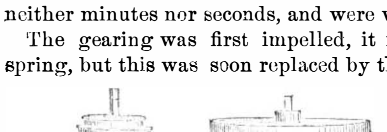
Balance and Escapement of the First Clock. P P, the Pallets.



DeVick's old Balance converted into the Pendulum.—P P, the Pallets.

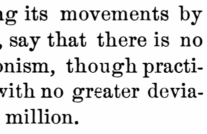
The old church-tower clock was the progenitor of the whole race of modern clocks and watches. It was gradually made smaller, and at length became portable with springs instead of weights, and was carried about the person under the name of the "pocket clock." This grew into the watch, the earliest of which were large, of an endless variety of forms, without crystals, and either having the face exposed, or with metallic covers perforated over the numbers of the hours on the dial. They opened back and front, had but a single hand indicating neither minutes nor seconds, and were wound twice a day.

The gearing was first impelled, it is said, by a straight spring, but this was soon replaced by the coiled mainspring, a band of fine steel rolled up in a drum, or barrel, and which produced, in unrolling, the effect of the weight. In the case of the clock, the maintaining force, or descending weight, was constant, but in the watch the spring acted with a varying intensity, becoming weaker as it was uncoiled. To equalize its effect, and secure a regular motion, the barrel inclosing the spring was made to act upon the main driving wheel by means of a catgut string coiled upon a spiral fusee. When, therefore, the mainspring was coiled up and pulled hardest, it acted upon the smaller end of the fusee, and the progressive loss of force in the spring was compensated by an increasing leverage upon the driving wheel. The catgut string was soon replaced by the fine, strong chain, consisting of several hundred pieces, which is still used in fusee watches, although the date of its introduction is unknown.



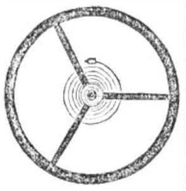
The Fusee. The Barel.

The balance used was simply De Vick's old clock balance in the shape of a wheel, the weight being accumulated principally in the rim which corresponded to the suspended weights on the horizontal lever.



The Watch Balance.

The first important improvement in the old watch, and, indeed the greatest ever made in its construction, was the application of the coiled hairspring to the balance. It effected for the watch what the pendulum did for the clock, and was introduced about the same time, a little over two hundred years ago. Dr. Hooke, who is one of the claimants of the invention, showed that the vibrations of such a spring are very nearly isochronous, and cause the balance to which it is attached to make its excursions in equal time whatever their length. The vibrations of the old balance depended upon its moment of inertia, and on the force of the train. The inequalities produced by the varying tension of the spring, and the varying friction, reappeared in the varying vibrations of the balance, and the irregular movement of the watch. But this was now avoided by the isochronism of the hairspring, so that, whether the balance moves completely round at each impulse of the scape wheel when the watch is first wound up, or but half a revolution, as when it is nearly run down, the rate of movement remains the same.



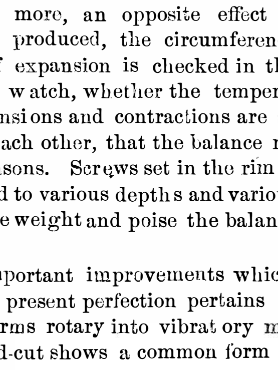
Balance and Hairspring

The next important step of improvement in watch construction was made one hundred and seventy years ago, and consisted in the application of jewels for the bearings of pivots. Precious stones were first drilled for this purpose by Nicolas Facio, a Genevan, but who brought out his invention in England. His contrivance not only reduced the friction of the movements, but gave them such permanence that they would run for generations without perceptible wear. Gems for this purpose are valuable in proportion to their hardness, which decreases in the following order: Diamond, sapphire, ruby, chrysolite, aqua-marine, garnet. Many suppose that watch jewels are made of glass; but this material is too soft and brittle, and is never used, unless it be in the lowest grade of foreign watches made for the "American market."

The next epoch in the growth of the watch occurred seventy years later, and still pertained to the balance. It consisted in compensating it for inequalities of temperature. As the watch was gradually brought nearer to accuracy, it was found that fluctuations of heat and cold altered the proportions of the machinery, so as seriously to disturb uniformity of movement. The length and stiffness of the springs were affected; but the main derangement occurred in the balance. With a fall of temperature it contracted, and, vibrating quicker, the watch gained time; heat, on the contrary, expanding it, lengthened the beats, and it lost time. With a change of thirty or forty degrees, the watch might thus vary two or three minutes in a day. It became essential that this source of error should be removed, for the world's commerce depended on it. A ship at sea could find its latitude at any time by observation of the sun or stars; but, to ascertain its longitude, it was necessary to have the exact time. France and Spain had offered large rewards for some way of finding the longitude at sea; and the English House of Commons, through a committee of which Sir Isaac Newton was a member, offered a prize equal to one hundred thousand dollars to whomsoever should improve the chronometer—the marine watch—so that a ship captain could determine his position at sea within thirty miles of the true place. In 1767, when the offer had been standing fifty years, John Harrison gained the prize by the invention of the compensation balance. It rests upon the principle that heat expands different metals unequally—brass nearly twice as much as steel, or in the proportion of one hundred and twenty-one to seventy-four. In the compensation balance the circumference is divided into sections, the ends of which are free, as illustrated in the figure. The outer rim, or tire, is of brass, and the inner rim and cross-bar of steel—these being soldered together, so that one expansion counteracts the other. Cold, contracting the inner steel rim, would reduce the circumference; but, as it contracts the outer brass rim still more, an opposite effect is produced, the circumference being enlarged. The effect of expansion is checked in the same way. In a well-adjusted watch, whether the temperature rises or falls, these expansions and contractions are so admirably played off against each other, that the balance remains constant through all seasons. Screws set in the rim of a balance, which may be altered to various depths and various positions, serve to distribute the weight and poise the balance accurately upon its center.

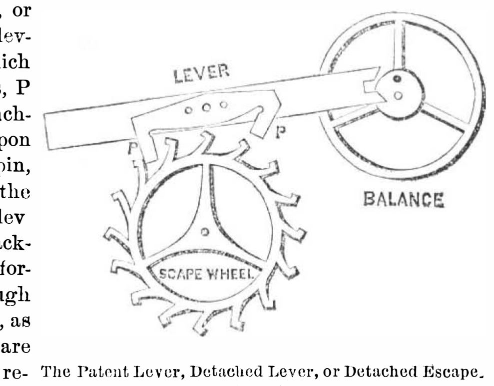
Compensation Balance.

The last of the series of important improvements which have brought the watch to its present perfection pertains to the escapement, which transforms rotary into vibratory motion. The accompanying wood-cut shows a common form of it, and recalls what we have all seen in the old caseless Dutch clocks. One would hardly think, from its simple and innocent appearance, that it has been the torment of mechanics and mathematicians for five hundred years. Yet it existed in the first clock, and its first construction and adaptation, no doubt, gave old De Vick many a hard headache; while the subsequent history of the variations, experiments, and theories of escapements, would make a cyclopedia. That which has been settled upon as the most perfect is known as the "patent-lever escapement," or the "detached escapement;" and this particular form of it is due to the joint and successive labors of the most eminent watchmakers of the last century—Berthoud, Le Roy, Earnshaw, Graham, and Mudge—all men of genius, and who made it a life study. The combination which has been selected by the American Watch Company, as nearest perfection, is represented in the subjoined diagram.



Dr. Hooke's Escapement.

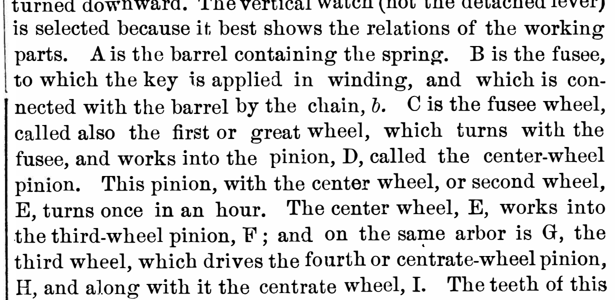
The bar, or "patent lever," to which the pallets, P P, are attached, turns upon a center pin, so that the ends of the lever move backward and forward through small arcs, as the pallets are alternately released from the scape-wheel. One end of the lever has a little nick in it, which, as it passes backward and forward, catches a pin upon the balance, and throws it right and left. As the lever, for example, moves to the left (see diagram), one of the pallets catches a tooth of the scape-wheel, and stops the train; at the same time the balance is thrown round, so that the pin passes out of the nick, and the balance swings free to the extent of the impulse—that is, it is *detached* from the lever. As it swings back under pressure of the hairspring, the pin catches in the nick again, and, moving the lever back, unlocks the pallet, when instantly the other pallet is caught by another tooth, and the lever throws the balance the other way. The balance, therefore, in its isochronal swing, throwing the lever this way and that, and alternately locking and unlocking the teeth of the scape-wheel, determines the rate of movement of the train.



The Patent Lever, Detached Lever, or Detached Escapement.—P P, the Pallets.

When it is desired to alter this rate of movement—that is, to "regulate" the watch—we have to regulate the regulator, which is usually done by altering the length of the hairspring. Shortening the hairspring is like shortening the pendulum—all the beats are made quicker; if lengthened they are all made slower. It is obvious, therefore, that the regulation of a watch is a matter of great delicacy, as whatever change we make in one beat, re-appears in every beat, and is multiplied three million times in the course of a week.

The accompanying cut represents the train of an English verge watch, the frame plates being omitted, and the face side turned downward. The vertical watch (not the detached lever) is selected because it best shows the relations of the working parts. A is the barrel containing the spring. B is the fusee, to which the key is applied in winding, and which is connected with the barrel by the chain, *b*. C is the fusee wheel, called also the first or great wheel, which turns with the fusee, and works into the pinion, D, called the center-wheel pinion. This pinion, with the center wheel, or second wheel, E, turns once in an hour. The center wheel, E, works into the third-wheel pinion, F; and on the same arbor is G, the third wheel, which drives the fourth or centrate-wheel pinion, H, and along with it the centrate wheel, I. The teeth of this wheel are placed at right angles to its plane, and act in the pinion, K, called the balance-wheel pinion, L being the balance wheel, scape wheel, or crown wheel. The scape-wheel acts on the two pallets, *m* and *n*, attached to the verge, or arbor, of the balance, M, which regulates the movement.



Movement of the Common Vertical Watch.

The exquisite working of a well-constructed watch is a matter of interesting reflection. By half a dozen turns of the key a modicum of force is stored up in the spring, and, in the running down of the train and the reaction of the hairspring against the mainspring, that force is cut up into half a million little beats, which are so exactly equal that in the most perfect form of the mechanism it deviates from the uniform motion of the stars but the fraction of a second in a year. There can surely be no loss or destruction here of even the most infinitesimal amount of force—a fact which ought long ago to have suggested the principle of the "indestructibility of energy." We lend to our watch each morning a little instalment of that vital movement which we ourselves borrow daily from the sun. One portion is spent in overcoming the friction of the train, and another portion in the percussion of the pallets, which sets the air to vibrating, and produces the ticking sound; but the force, though infinitely disintegrated, does not come to nothing—it is all converted into heat. And thus the solar heat, after undergoing a series of organic transformations, is deposited as mechanical force in the watch spring, and is at last converted back again into heat and radiates away into space. The daily running down of the watch, therefore, symbolizes that mighty dissipation of solar energy and running down of the solar system which is now inferred to be a consequence of the laws of physics.

We have seen that the watch has been brought to its present state in a gradual way. A little examination will now shows that this advance has been governed by a definite and important principle—a regular law of growth or development. But in what sense, it will be asked, can a watch be said to *grow?*

Those who have studied the phenomena of life tells us that growth consists in a change from the uniform or homogeneous state of the germ to the heterogeneous condition of the organism. The change, by which unlike parts become different and distinct, is called "differentiation," and the further change, by which unlike parts become more closely dependent, or unified, is termed "integration." Hence, as we ascend in the scale of development, there is increasing differentiation and a higher integration. Now, we have reason to think that this is a great principle of Nature, not limited to bodily growth, but applying equally to society, to art, and to industry. Both the watch and watchmaking industry furnish striking and instructive confirmation of this statement.

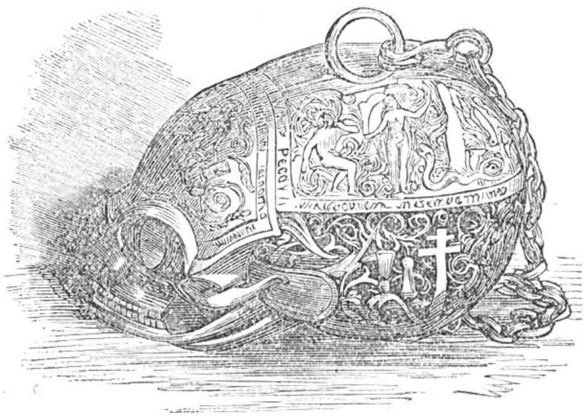
In the infancy of the art, when the watch was made by hand and by one man, the idea of a time-keeper was but imperfectly differentiated; that is, it was mixed up in the artisan's mind with all sorts of foreign and fantastic notions. Instead of a mechanism simply to measure time, the watchmaker was constantly striving to produce something novel, curious, and astonishing. The forms and sizes of watches were innumerable. Some were as large as saucers, and others were of the most marvelous minuteness. One is still preserved in a Swiss museum but three sixteenths of an inch in diameter, set in the top of a pencil-case, which indicates the days of the month, as well as the hours, minutes, and seconds. In form they took the shape of the pear, the almond, the melon, the tulip, the shell, the bird, the cross, the skull, the coffin, etc., and they were inserted in snuff-boxes, finger rings, shirt studs, bracelets, and saddles. A bulky book has lately been published on the curiosities of watches, which is little else than a record of the whimsicalities and futile ingenuity of watchmakers in accordance with the capricious and fantastic taste of the times. The notion of a "time-keeper" at length emerged into distinctness, became gradually predominant in the maker's mind, and determined the watch to its present settled form.


The Watch as a Double Cross.

But even when these external eccentricities and extravagances had been largely got rid of, the inner construction remained complicated with all manner of objects besides simple time-keeping. There seems to have been a phase of the human mind when mechanical invention was subordinated to the production of wonders; and ingenious men gave their lives to the construction of the most intricate and useless machines, such as artificial, automatic animals, which should simulate the actions of living creatures. This singular ambition long displayed itself in watchmaking.

Watches, striking the hours and quarters, were made with the most elaborate ornamental open-work for the emission of sound. Musical watches that played tunes, and speaking watches that imitated voices, were produced as expensive toys for the rich; chimes, alarums, stops, self-winders, and repeaters, and watches indicating the day of the month and the chauges of the moon, continued for a long time to be exploited by ingenious makers, although all these appendages were drags upon the works, and detracted from the simple, essential purpose of the mechanism. It was only by that gradual differentiation of human thoughts and feelings, by which the conception of *utility* grew into greater distinctness, that there was a corresponding differentiation of the watch as a simple time-keeper, and a concentration of effort to perfect this object alone. The appendages were gradually abandoned in watches of the best construction, and, when the American Watch Company resolved to transplant this ancient industry of Europe to the soil of this country, and establish it upon a new method, such an enterprise was made possible only because the watch, reaching its last stage of differential growth, had become simply a time-keeper, and because the idea of the useful and serviceable had become so clear and strong in the American mind as to assure its general appreciation.

Yet the watch, although completely differentiated in purpose, was not completely unified, or integrated, as a mechanism. Every essential step of invention from the outset had tended to bring the parts into more close and perfect dependence, so as to execute its design with the utmost precision. Each incidental and complicating part, and each liability to error or failure that had been eliminated, was a step of growth toward completer integration and more perfect unity of the mechanical structure. But when the American Watch Company entered upon the manufacture, they found that the watch had been by no means reduced to its last degree of simplicity. The English movements of the highest character, although performing well, were still exceedingly complex, and, as the risks of derangement in any machine are, other things equal, in the ratio of its complexity, it was in a high degree desirable to relieve the contrivance of every part not absolutely essential to its purpose. Determined to prune the watch of every superfluity, and bring it at once to the last term of simplicity, consistent with its design, the engineers of this company at once struck away the fusee, chain, main wheel, and the retaining power which those parts necessitated. Surprising as it may seem, by this bold stroke more than three fourths of the pieces comprising the watch were swept away. The chain alone consisted of several hundred pieces, so that, of the eight hundred parts of the first-class English watch, but one hundred and fifty-eight remain in the movement adopted by the American Company.



The Watch as a Skull.

This was a most important step, as the advantages of removing the fusee and its complex appendages were numerous and important. In the first place, the watch could be produced at a much less cost. The chances of failure from flaws in the workmanship were, besides, greatly reduced. The friction of the train was diminished by one half, so that thinner and lighter springs could be used, which are more lasting and equable in their action. Moreover, the parts got rid of were the most difficult and expensive to repair. When brought to the supreme test, that of "performance," the simplified American watch, furthermore, bears comparison with any other; the wide and free motion of the isochronous balance proving quite sufficient to govern and equalize the movement.

That the English should still retain these superfluous parts in their watches, is simply due to their conservative habits, as their highest authorities have pronounced against them. Still, there are Englishmen who can appreciate the best thing, regardless of national prejudice. Mr. Herbert Spencer, for example, a keen and inexorable critic, regulates his life by an American integrated watch; and, under the test of constant competition with the finest English time-keepers, he bears cordial testimony to the precision and perfection of its performance. The perfected American watch, in the simplicity, accuracy, permanence, and cheapness of its construction, represents the highest stage in the growth of the watchmaker's art; it is the result of a great law of advancing industry.

THE WATCH AS A GROWTH OF INDUSTRY.

From the Marquis of Worcester's first foreshadowing of the steam engine to its completion by Watt, was but little more than a century; Galileo's spyglass developed into the forty-foot telescope of Sir William Herschel in one hundred and seventy years; the electric telegraph germinated in the experiments of Watson and Franklin in 1747, and was patented by Morse in 1837; while the Cathedral of St. Peter, from its foundation to its dedication, took one hundred and seventy-five years. But the pocket watch is the out-come of the accumulated skill of thousands of men for more than twice these longest periods; it is a compend of four centuries of advancing science and art.

Were there but one watch in existence, as there is but one St. Peter's, it would undoubtedly be regarded as the greatest wonder of man's creation. It would be said, "The concentrated wit of fifteen generations has produced from a few shreds of metal a pocket solar system, which reports with perfect precision the rate of Nature's on-goings, and to which the fortunate possessor unhesitatingly commits the order of his life."

But the watch is no rarity in the museum. Wonderful as it is, ingenuity and perseverance have compassed the possibility of its endless multiplication. Once the luxury of the rich only, it is now the necessity of all. Nor is watch-making any longer the mere matter of a few years' apprenticeship to mechanical shop work. As it required the sagacity of centuries to work out the conception of the watch, so it has required the mechanical discipline and resources of centuries to work out its construction.

We have seen that the ideal watch has had its laws of growth; we are now to see that the industry which produces it has been equally a growth of time; and illustrates still more strikingly the same laws of development. And this, let us here remark, is something more than a mere curious speculation; it is nothing less than a principle of practical guidance for the watch buyer. If industry advances and has its gradations of perfection, its products must be correspondingly graded. With respect to an article of which he is no judge, the most important clew the purchaser can have is a knowledge of the industrial conditions under which it was produced.

For nearly three hundred years watches were made by individual labor alone. Each artisan fabricated all the diversified parts of the watch, and all the tools with which they were made. This was the germ state of the industry, so that the watchmaker of those times resembled one of the lowest kind of animals, as the polyp, in which each part of the body carries on all the vital operations of digestion, circulation, assimilation, and excretion. The differentiation of this kind of labor had not commenced; the watch was the product of a homogeneous industry in which the work, slowly done, was inaccurate and expensive. The earliest watches, it is said, took a year to construct, cost the equivalent of fifteen hundred dollars apiece, and varied in their performance from forty minutes to an hour a day.

It is scarcely more than a century since the great principle of the division of labor began to be introduced into the business, one mechanic devoting himself to one branch, and another to a different branch. This was the first step in the development of the industry, and resulted in a vast economy of exertion and in improved work, as, by confining himself to a single part, each workman could produce it, not only more perfectly, but quicker, and therefore cheaper, than by distributing his efforts over a multitude of operations. This division of the industry into separate branches grew rapidly, and became immensely extended. In an examination before a committee of the House of Commons it was stated that there are a hundred and two distinct branches of this art, to each of which a boy may be put apprentice, while after mastering it he is unable to work at any other. This differentiation of watchmaking industry was an immense step in the direction of its true development; but it was only a transition step, and, as we shall presently see, it had its evil as well as its good results.

Division of labor, applied to the production of watches, produced different effects in different countries. In England, it both cheapened work and improved it. The English were the first successful watch manufacturers. Being the greatest maritime nation, they were driven to the improvement of the marine chronometer, which demanded the highest accuracy of workmanship, while the discipline of thoroughness which this necessitated, and which is, besides, a noble trait of national character, enabled them to give an excellence to pocket watches which made them preferable to all others. But that country did no more than supply the world with excellent but costly watches, the genuine English watch being always expensive.

The French and Germans have never been able to establish a large and permanent watch manufacture. But the Swiss, from the very low price of labor, the absence of other industries, and the extensive employment of women and children—by which occupation is given to families who do the work at home—have been able to triumph over all competition, and to lead in furnishing watches to the markets of the world. In Switzerland the division of labor has been carried to its utmost extent, and all its consequences fully realized. In the first place, such is her unrivaled cheapness of production that she has undermined the manufacture in the other European countries, which now send to Switzerland to have the pieces of their own watches made. Even English watches now have nearly all their parts made by the Swiss; and so disastrous has been the competition that it is declared, by high authorities in the London *Horological Journal* that three fourths of all the watchmakers' tools in England are now in pawn. But, with extreme cheapness, this highly-diversified industry brings also inferior work; for it is unlike the case of pins and screws, where the article is so simple that divided labor cannot impair its quality. The watch is a highly complex thing, and the due performance of its functions depends upon the perfect co-ordination of its parts. Each piece is brought to the rigorous test of exact co-operation with a whole system of other pieces; and, as the strength of a chain is determined by that of its weakest link, so the quality of a watch is determined by the accuracy of its least perfect part, one flaw vitiating the whole result. But, when a hundred different personalities of hand labor have been stamped upon these parts, it is mechanically impossible that they should come together with the precision and perfection that the mechanism requires. How far from perfect the best of this work is likely to be, may be inferred from the fact that one third of all the pieces made are rejected as imperfect, though they are still thrown together, covered with showy cases, and sent to different markets. It is obvious, therefore, that mere division of labor cannot produce a perfect result, while the further it is carried the greater are the chances of error and imperfection.

When the division of labor had reached a certain point, competition was sure to produce one of two results: either the industry itself must advance to a higher stage, or the manufacture must deteriorate. That point was reached when the Swiss obtained the virtual monopoly of the production; and, as the manufacture did not develop a new order of resources, the alternative step was taken, and the business degenerated in character. If the watch could not be made perfect, it must be made to *appear so,* and its imperfections be concealed. The door was thus opened to endless deceptive practices. Smooth and highly polished work, which everybody can see, and which is done by children, is cheaper than accurate work, which requires skilled labor, and of which but few can judge. It was consistent with division of labor, aiming at cheapness, to give a high finish to non-acting surfaces, while it was not consistent with it to give the utmost perfection to those parts upon which the working quality depends. Again, a watch got up with a fine appearance, but with no reference to permanent use, may still be safely warranted for a year or two, because "wear" does not take place in that time, and an essentially worthless article may perform well for a season. Thus a disjointed and piecemeal labor, competing for cheapness in the production of an article of which people generally are no judges, has led to systematic imposture, and the products of a fraudulent commerce are scattered broadcast over the country, while its victims are taxed millions of dollars annually for the repair of shabby and dishonest work.

We have here the legitimate consequences of a half-developed industry. Watchmaking had been highly differentiated, but only in a low degree integrated: genius and enterprise had not yet been directed to organize and concentrate its operations.

The efforts that have been made from time to time in Europe to combine the numerous branches of the business in single establishments were all abortive, and served only to show that the need was recognized, although the conditions of its fulfillment were absent. The despotism of the conservative spirit, the dominance of hereditary habits, the cheapness and competitions of labor, and the ignorance and stolidity of factory operatives—all combined to prevent that final perfection of the industry which consisted in the unification of its multiplied processes. It is a significant fact that this important branch of modern industry, though created by European genius, and rooted in European experience, with boundless capital at its command, and carried on by communities of artisans who were trained in watchcraft generation after generation, and that, too, under all the stimulus of national rivalry, should nevertheless be first brought to its highest stage of development in this country.

Half a century after Europe had perfected the mechanism itself, the American mind perceived that another step remained to be taken, and that, to give the world the full benefit of all that had been done by the constructive ingenuity of the past, the watch must be made by machinery, and all the hitherto separate branches of labor be combined in one establishment and under one direction. It is not yet twenty years since the company was formed which built the first American watch factory at Roxbury. The undertaking was certainly a formidable one. The various sporadic attempts to make watches in this country by hand, commencing in 1812, had all failed, and there was no body of disciplined workmen to start with. Besides, the Swiss authorities would not permit the exportation of such machines, models, or drawings, as were already in use—so that the American managers of the project were thrown back upon first principles, and had to invent their own machinery, and train their own workmen. The first experiment was thwarted by geological causes, the lightness of the soil producing a fine dust, which, although unheeded in other vocations, was fatal to the delicate operations of watchmaking. The factory was therefore removed and located on the banks of the Charles River, a little above the village of Waltham. Embarked in a novel, expensive, and, as many thought, a Quixotic enterprise, the managers pursued a cautious but vigorous policy, and the first factory, which was even then thought to be of great dimensions, rapidly expanded into an immense establishment, filled with machinery superintended by seven hundred hands, and turning out some eighty thousand watches a year—more than are produced in all England, and three times as many as are made in any other establishment of the kind in the world—while it is the only establishment in the world which makes the entire watch, case and all.


Gilding the Wheels.

An English watchmaker, in a recent lecture before the Horological Institute of London, describing the results of two months' close observation at the various manufactures in this country, remarked in reference to the Waltham establishment, "On leaving the factory, I felt that the manufacture of watches on the old plan was gone." It was thus ingenuously confessed that American enterprise had made an industrial epoch, and beaten Europe in one of her oldest and most difficult productions. In this there is neither accident nor mystery, but it is the result of a great law that can no more be resisted than the flow of the Gulf Stream or the advance of knowledge. An industry which stagnated for three centuries in an undeveloped condition, and which had been disintegrated for the last hundred years, was now for the first time brought into an all-connected and perfectly organized system. The engraving on the first page discloses the secret of this important revolution. It shows how completely the multifarious operations of this delicate craft are combined and unified, yet it represents but one department of the establishment. Single tools, which gradually grew into simple hand machines, with which a few of the parts of the watch had been produced, were here brought together, and hundreds of new ones, at many hundreds of thousands of dollars' cost, were created, and all interwoven, as it were, into one vast mechanical organism. A single steam engine distributes its power by means of driving shafts through a whole colony of similar working rooms, and the result is the production of watches at the rate of one every three minutes, and with a uniformity and perfection which have at once and forever antiquated all previous methods of the production. "The manufacture of watches on the old plan is gone," because the laws of growth have carried the industry to a higher stage of development. Let us note some of the conditions of this industrial advance. The first great point of advantage here secured is critical and decisive in watch work; it is the highest possible accuracy of construction. The delicacy of hand operations is often remarkable, but it is only attained with great effort, and is always variable. It has, besides, its limit, which falls immeasurably short of the exactitude demanded in watch-machinery. When we approach the finest action of the nervous system, we pass beyond the control of the will, and errors become inevitable. Lace makers, who work along the utmost border of tactual and visual sensibility, afford striking illustrations of this fact. Even the re-actions upon the nervous system, which come from mere change of locality, re-appear in the quality of the tissue. When a lace maker begins a piece of fine work in the city, and finishes it in the country, the transition can be detected in the fabric, which will present two distinct aspects. Again, what is called the personal equation of telescopic and microscopic observers, is simply that source of error, in looking sharply at a fine object, which yields different results with different persons, which depends upon temperament, varies with the period of life, and has to be discounted in individual cases in order to arrive at the exact truth. Now watch work, in the precision it requires, takes us beyond this range of nervous aberration; it is, if one may so speak, trans-visual and trans-tactual, so that the only way to get rid of errors is to get rid of personality itself. This is precisely what the American Watch Company does, it commits the whole work to machinery, and thus secures the accuracy and uniformity that machinery alone can confer. The adjustment of parts is made with mathematical precision far beyond the reach of unassisted sense. It is not merely exactness of *fitting* that is here demanded, but, what is far more difficult, the minutest nicety of permanent *action*. With precision there must also be freedom of movement, and each pivot must have its infinitesimal play for "side shake" and "end shake;" otherwise, an atom of dust or a rise of temperature would lock the parts, and stop the motion. To get this systematic exactness, three grades of gages are used; the first and coarsest measuring to the $\frac{1}{250}$ of an inch; the second to the $\frac{1}{1250}$ of an inch; and the third to the $\frac{1}{17000}$ of an inch. Thus nothing is left to the eye or the touch of the workman; he commits himself to the mathematical guidance of his gages and to the precision of his machinery, and stamps an equal and certain accuracy upon the whole mechanism. The old watchmaker disappears, and the whole art is resolved into the construction of correlated and unified machinery on a very extended scale. Still, intelligent human agency is by no means superseded.


Enameling the Dials.


Firing the Dials.


Gold and Silver Working.

The most accurate machine, like all earthly things, has its imperfections, and these the skillful workman is ever on the alert to detect and rectify. By no lathe, for example, is it always possible to get a pivot turned exactly round. It has to be tested by gages, and brought to a standard in which the errors are less than the ten-thousandth of an inch.

We have no space to describe or even to enumerate the multifarious operations of this immense establishment, although we found every department of it rich in curious instruction. We desire only to illustrate some of the difficulties that have been vanquished by machinery, and to show how the manufacture has been developed through the extensive integration of its numerous processes.


Minute watch-screws.

The very first thing that arrested our attention upon entering the factory was a little boy making screws. At first we could not conceive what he was doing, for the screws he made were so fine that it takes nearly a hundred and fifty thousand to weigh a pound. On white paper they look like tiny dots, or specks, and are much less distinguishable than the little cuts here represented. Yet, when viewed with a strong magnifying glass, they appear like perfectly-finished little bolts. Though having two hundred and fifty threads to the inch, yet the taps and dies are so perfectly matched that the screws go closely and firmly to their places. They are made of fine steel wire, in lathes driven by steam-power. The end of the wire is applied by the attendant to the revolving die, and the thread is cut, and the head marked off and partially severed, almost instantaneously. The operator then inserts the screw into a little bar, with prepared holes to receive it, and snaps off the wire. Another is made in the same way, and inserted beside the first. A row of them is thus set in an exact line, when the heads are pared down and polished by passing them over one wheel, and the slots are cut in the whole series by passing them over another. They are then unscrewed from the bar, and, after being tempered, are ready for use.


As they appear under the Microscope.

These almost infinitesimal screws are made with great rapidity, and are nevertheless such exact duplicates that they may replace each other indifferently. This principle of the equivalence of parts pervades the whole construction of the watch.


Punching Blank Wheels.

The most conspicuous as well as important parts of the watch are the wheels, which require to be brought to the highest possible perfection in two points, the teeth and the pivots. Let us see how these are attained by machinery. The wheels are made from the thin ribbons of sheet-brass. These are passed rapidly through a punching-machine, which cuts out a blank or outline wheel at every stroke. A large number of these are then threaded upon a rod, or spindle, and screwed firmly together. They are now placed in the tooth-cutting machine, where a rapidly revolving tooth plows a groove, or furrow, along the surface from end to end. The spindle then turns on its axis the width of one tooth, and another groove is cut beside the first. This is repeated sixty or eighty times, according to the number of teeth required in the wheel, and a girl will finish in this way ten or fifteen hundred wheels in a day. The most difficult wheel to make is the scape-wheel, owing to the peculiar shape of its teeth. A figure of it is given of ten times the actual size. We also represent the machine by which it is cut. Thirty punched blanks at a time are placed upon the rod, which is then inserted in the machine, where it moves backward and forward horizontally. The end of a large cylinder is represented, which contains within it six lesser cylinders, and each of these carries a cutting-tooth pointed with sapphire. One of these small cylinders is now set going at the rate of eight thousand revolutions a minute, the horizontal rod at the same time moving steadily forward, and thus a groove is cut across the edges of the thirty mounted blanks. By automatic action, the horizontal rod slides back to its former position, and the large cylinder turns sufficiently to bring the second of the smaller cylinders with its mounted tool into place. It, in turn, is set to spinning; the rod slides forward as before, and another portion of metal is cut away. When all the tools have been thus successively applied, the large cylinder has made a single revolution, and

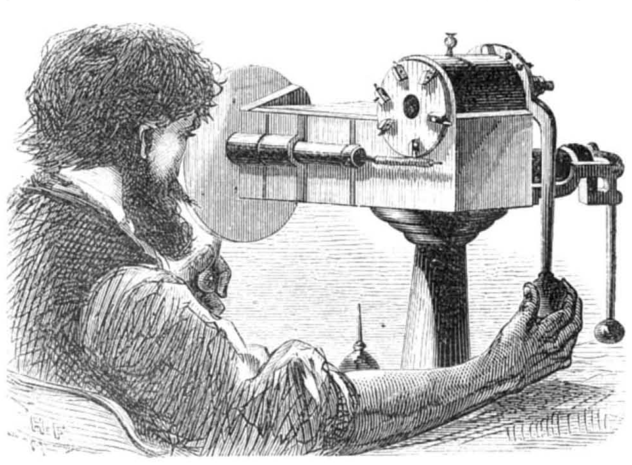

Scape-wheel magnified.

a single tooth on each one of the thirty blanks has been finished. In this way the scape-wheels are turned out, thirty at a time, all exactly alike, and each tooth a perfect geometrical copy of each other. The machine thus combines rapidity of execution with the highest possible perfection of work.

So much for the teeth of watch-wheels. Let us now consider the pivots—the little hardened-steel points upon which they run. This brings us to the most interesting part of the manufacture—the very romance of mechanics—the jeweling department, for the pivots run in perforated jewels. We have here the highest accuracy of human workmanship executed in adamant. That the watch may be "immortal as well as infallible," all its points of friction must be made of the hardest substances that Nature produces, and these are the precious stones—ruby, sapphire, chrysolite. They can be only worked by tools of diamond and by diamond-dust. Diamond drills and chisels are made by skilfully working one diamond against another. Diamond-dust comes from Holland, and costs five dollars a carat, equal to seven thousand dollars a pound troy.

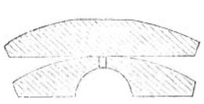
The stones to be cut, which come chiefly from South America, and are growing scarce, are little rounded pebbles. These are first cut into slabs by a gang of thin circular saws of soft iron, the smooth edges of which are toothed with diamond-dust applied in oil, the little diamond particles being bedded in the soft iron by turning against a steel roller. The stone is then pressed against their edges and rapidly cut through, a specimen larger than a pea being sawn in slices in forty-five seconds. The slabs are then skillfully broken into minute pieces, and are ready to be turned in the lathe.

When the American Watch Company commenced business, jewels were only made by hand mechanism and by imported experts. Even these could not make their own tools, but had to send to England for them. The extending operations of the factory, by which one part of the watch after another was first produced by machinery, did not alarm the jewel makers, who said, "You will never be able to disturb *our* branch of the work." But they were informed, one disagreeable day, that the thing was done, and their monopoly ended. Machinery, worked by steam, had been applied so successfully, that jewels, more perfect than those before made, could be produced by girls after a week's practice.


Escapement-wheel Machine.

In watches of the best construction all the bearings of the pivots are jeweled, and little bits of precious stones of microscopic precision of form are also set in the pallets to act upon the teeth of the scape-wheel.

The watch, bearing the trade mark of the "American Watch Company," is completely guarded against wear by fixing precious stones at all its essential working points; it contains nineteen jewels, while the watch next lowest in grade contains seventeen. The balance-jewel always has an *end-stone*, or cap, as represented in the cut, the balance running on the end of its pivot in order that it may have the utmost freedom—the pivot being but the $\frac{1}{100}$ of an inch in diameter. Diamonds are sometimes used for end-stones, but rarely, if ever, for jewels, it being next to impossible to drill a hole sufficiently small in so hard a substance.


Jewel with End-stone, or Cap.

It is here, in matching the jewels and pivots, that we meet with the first exception to the policy of American watch construction; but even this, so far from being a real exception, forms the most impressive illustration of the perfection to which the system is carried. In forming all parts of the watch, one piece is so exactly like any other of its kind, that a thousand might be taken to pieces and mixed up, and then reconstructed with pieces taken indifferently. But in opening out and smoothing the fine jewel-holes, and in giving to the steel pivots their exquisite polish, microscopic differences arise which make it necessary to match them by exact measurement. The pivots are first classified by a girl, with a gage which measures to the ten-thousandth part of an inch. The jewels are then similarly measured and classified, and jewels and pivots of the same number exactly fit. But for each pivot of a particular watch a jewel is selected, with a hole which is a degree or ten thousandth part of an inch larger, so that there may be sufficient play. Each watch is numbered, and the exact size of all its pivots and jewels is accurately recorded. Note now the advantage to the watch-owner of this highly perfected system. If any minutest part of his watch fails, wheel, escapment, pivot, or jewel, in whatever part of the world he is, if it is reached by the postal system, he can write to Waltham, and by return mail get an exact duplicate of the failing piece. Thus, in its highest stage of development, this complex and beautiful industry has itself become integrated with the highest and most comprehensive agencies of modern civilization.

Of course, in producing a work of such complexity as the finished watch there must be many operations which are largely manipulatory; such, for instance, as enameling and firing the dials, melting, purifying, and casting metals, gilding the works, etc., some of which operations are here pictorially illustrated. But in all these processes numberless ingenious devices are introduced for simplifying and expediting the work, while so great is the magnitude of the production that it secures the utmost limit of industrial economy.

When all the parts of the watch are finished, they are brought to the train room and put together, and then pass into the regulating department to be adjusted. This is indispensable, as no attainable exactness of workmanship, though the most expert and experienced finisher spent half his lifetime upon it, can produce a watch which, when first set up, will run with precision. The train may move with accuracy, as it is passive; but the will and temper of the more living parts are not to be caculated upon beforehand. The conflict of the springs—the mainspring steadily forcing the hair-spring, and the hair spring striking back half a million times a day—must be composed and harmonized. And so the adjustor sits down to the watch like a physician beside his patient, notes its languid or fevered pulse, and makes such regulative prescriptions as will bring it to normal action.

But the door to extravagance is here widely opened. Watches, are, in fact, like horses. There is the practical roadster, and the valuable carriage horse, for daily, substantial service; and there is the high-blooded race horse, expensive, delicate, requiring sedulous care, of no use except upon a few grand occasions, and then only of a *fancy* use. So there is the substantial every-day watch, moderate in cost and reliable in performance; and there is the highly finished, exquisitely adjusted article upon which, like the race horse, you can expend a great deal of money for a few seconds of time. Such, however, are demanded, and so the American Watch Company produces them. But they are, of course, costly, because of the amount of attention which must be given to each individual watch. It has to be put through a six months' course of training, tried repeatedly in all positions, torrified in an oven, chilled in a refrigerator, and so exactly adjusted that none of these changes will disturb its rate of going. But these watches entail upon their possessors the most vigilant care, if the fine results they are intended to give are to be realized. It is to the manufacture of the simplified and substantial watch, elegant but not gaudy, and running with all desirable accuracy, such a watch as everybody can afford and depend upon, and which is cheapened by improved production without being lowered in character, that the American Watch Company has brought its resources of skill, enterprise, and capital.

Let us now see what is the gain to the public of this higher development of watch-making industry. It is commonly said that the price of any commercial article depends upon the proportion between the supply and the demand; and this may be true of such things as wheat and coal, of the quality of which the customers are competent judges. But in a large class of commercial articles another element comes into the case, and that is the guarantee to the purchaser of the excellence that is alleged. The buyer has to pay for two things: first, the cost of production of the thing purchased; and, second, the cost of verifying its character. The goodness of loaf sugar, for example, is so obvious at the first glance that the consumer requires no guarantee of it, and of course will pay for none; but tea, on the other hand, is something of which it is very difficult to judge, and the consumer has to pay for the assurance of its quality. Hence, the price of loaf sugar is uniform, the profit on it is small, and the grocer not desirous to sell it. The price of tea, on the contrary, is variable, the profit on it large, and the dealer anxious to sell. This leads, to mixing different grades, to adulteration, and to reckless lying about its properties. He who should devise some means by which tea could be judged of as accurately as loaf sugar would save the cost of verification in this article and stop imposture, though, in doing the public a service, he would, at the same time, incur the hostility of the grocer.

Now, of all articles of commerce (except drugs), there are none which illustrate this double element of cost in as marked a degree as watches. We pay fairly for their actual production, and then we have to pay a still larger price to be assured that they are good. This last payment is the trader's great source of profit, and he is doubly tempted to make the most of it by his own greed and by the buyer's credulity and inexperience. Most purchasers know nothing of watches, and are without protection against the plausible deceit and urbane extortion of avaricious dealers. This again reacts against the purchaser, for, with the prevalence of trade frauds, the premium for verification rises, so that in buying a "Frodsham" or "Jurgensen" we pay one price for the making of the article itself, and two or three more to be assured that it is what it professes to be.

It is here that the American Watch Company comes to the protection of the purchaser. It relieves him of this exorbitant charge for verification. The unrivaled organization of its industry is a pledge of superior work, which public experience has abundantly justified, and is the purchaser's sufficient assurance of the character of the article; and, as he needs no guarantee of the trader, he may justly demand it at a moderate profit. Resting in its superior advantages of production, this company is working for a home market, and has an interest in cultivating the friendly feeling of watch buyers by giving them full value. Unlike the unknown and irresponsible makers who send their watches across the ocean, where they may never hear of them again, it appeals to the intelligence of the American people, by whom it may be always reached, and held to its guarantee that all Waltham watches have the character they are represented to have.

The two great systems of watch production—the American and the Swiss—are now in conflict; the one representing a highly developed, and the other a half-developed industry; the one appealing by a direct and open policy to the interest of the consumers, and the other to the cupidity of dealers through the artifices of trade. That many dealers should prefer to sell a foreign article at a speculating advance is perhaps natural; but the buyer should remember that their hesitancy in commending the Waltham watch, or their depreciation of it, is his guarantee that he gets *that* article by paying a moderate profit. In making inquiries of a reputable jeweler as to the cause of the popularity of Swiss watches with the trade, he frankly answered: "They are popular with the trade *because they afford a large profit to both jobber and retailer*." The tactics of many dealers thus become sufficiently transparent.

There is another advantage which the public gains from the patronage of well made watches, which, although it may be thought remote, deserves to be better appreciated; it is derived from their durability and permanence of value. Commercial articles have a wide range in this respect. Matches and cigars, for example, perish in a single use, while precious stones lose none of their value by centuries of wear. The full jeweled, thoroughly made watch, with the care that is suitable to it, ranks almost among indestructible things. We often meet them running well after fifty or sixty years' use; those that have seen a hundred years are not rare; and one was exhibited at an English antiquarian fair which was made two hundred years ago, and was still a "going watch." With the higher perfection of modern manufacture the wearing quality is increased, so that a well-made watch, well cared for, should outlast many lifetimes. And what object is so fit for transmission in families from generation to generation as the watch—a thing so beautiful, so personal, so social, which daily takes its life from its owner's life, and thus links the rising children to the disappearing parents in a kind of vital continuity, while around it cluster all the tender reminiscences of loved ones that are gone? What relic of the past is so suited to stir the deepest sensibilities as that by which an ancestor has guided the course of his life until time removed him to where there is time no longer?

We may perhaps have too little of this feeling, as Europe may have too much of it; but while we wisely refuse to parcel out the earth for the lineal glory of a few families, we should not neglect the lesser family mementos. The American watch has eminent claims as the true Republican heirloom—a triumph of industry in an age of industry, it symbolizes the progress and dignity of labor; a product of American enterprise, it is associated with the sentiment of patriotism; moderate in cost, it is accessible to the body of the people, and, thoroughly made, it is prepared for a lengthened future. Of the half a million which the American Watch Company has already constructed, many are no doubt destined to be prized by our distant descendants. When a hundred years have rolled away, and the continent is reclaimed to civilization, and telegraphs inclose the globe like a net, a white-haired man shall say: "My son, when I pass away, I shall leave you this watch. It has been in our family for a century. It was made at the great center of the watch manufacture—Waltham—and was one of their earliest productions, when they had revolutionized the industry, and transplanted it to the New World; it was my grandfather's inseparable companion through the great civil convulsion which ended slavery in the United States; it has counted out the precious minutes for two generations, and it will soon mark the moment of my own departure; it has been a faithful servant; cherish it with care for its fidelity and its sacred memories.'

In closing this article we would call attention to one feature of the Waltham Watch Factory which impreses the thoughtful visitor with a feeling of sincere gratification; it is the fine æsthetic taste which is manifested in all its arrangements and surroundings. Nothing, certainly, is more fitting than that a thing so exquisite as the watch should be born and cradled amid scenes of beauty, or that those who produce it should be surrounded by the most tasteful and agreeable influences. There is nothing that suggests the usual close and sunless dinginess of the manufactory. Windows, opening at all points of the compass, let in floods of light, give access to the fresh breezes, and open the prospect to the most charming scenery. On one side is the beautiful river, on the other an elegant park surrounded by the neat cottages of the workmen, while the quadrangle within, with its summer house and fountain, is filled with neatly kept shrubbery. Even the engine room, usually a grimy and greasy den, is here a spacious conservatory crowded with all varieties of plants, and festooned with flowers. In fact, the whole aspect and spirit of the place betray the intelligent sympathy of the managers with their large family of working people, men, women, and children.

There is something here more than mere sentiment. In carrying machinery to such a pitch of perfection as is here attained, and in changing dead hand labor to a mere light superintendence, the mind is greatly released, and is left free to interest itself in surrounding things; and thus, by offering to the contemplation of the laborer the beautiful things of art and nature, he not only has a constant source of pleasant and improving suggestion, but the frame of mind so induced cannot fail to react favorably upon the work performed; pleasant feelings are ever a stimulus, while painful ones are depressing and obstructive. There is, indeed, to us a still deeper meaning in this kindly solicitude of the American

Watch Company for the enjoyment of their employés? Does it not foreshadow that grand step which yet remains to be taken in the growth of the world's industry, the final harmony and complete integration of the interests of employer and employed?

Manufacture of Russia Sheet Iron.

Herbert Barry, Esq., late director of estates and ironworks of Vuicksa, thus describes the manufacture of sheet-iron in Russia:

"The refined iron is hammered under the tilt hammer into narrow slabs, calculated to produce a sheet of finished iron two archimes by one (fifty-six inches by twenty-eight inches), weighing when finished from six to twelve pounds. These slabs are called *balvanky*. They are put in the reheating furnaces, heated to a red heat, and rolled down in three operations to something like a sheet, the rolls being screwed tighter as the surface gets thinner. This must be subsequently hammered to reduce its thickness and to receive the *glance*. A number of these sheets having been again heated to a red heat, have charcoal, pounded to as impalpable a powder as possible, shaken between them through the bottom of a linen bag. The pile then receiving covering and a bottom in shape of a sheet of thicker iron, is placed under a heavy hammer; the bundle, grasped with tongs by two men, is pocked backwards and forwards by the gang, so that every part may be well hammered. So soon as the redness goes off they are finished, so far as this part of the operation goes. So far they have received some of the *glance*, or necessary polish; they are again heated, and treated differently in this respect, that instead of having powdered charcoal strewed between them, each two red hot sheets have a cold finished sheet put between them; they are again hammered, and, after this process are finished as far as thickness and *glance* goes:

"Thrown down separately to cool, they are taken to the shears, placed on a frame of the regulation size, and trimmed. Each sheet is then weighed, and after being thus assorted in weights, are finally sorted into first, second, and thirds, according to their *glance* and freedom from flaws and spots. A first class sheet must be like a mirror, without a spot in it.

"One hundred poods of *balvanky* make seventy lbs. of finished sheets; but this allowance for waste is far too large, and might easily be reduced. Four heats are required to finish.

"The general weight per sheet is from six to twelve lbs., the larger demand being from ten to eleven lbs.; but they are made weighing as much as thirty lbs.. and may then almost be called thin boiler plates, being used for stoves, etc. Besides the finished sheets, a quantity of what are called *red sheets* are made, which are not polished, and do not undergo the last operation.

"Taking the Michælofskoi Works, which are the largest sheet-iron ones in the Empire, I found that the power running the sheet rolls was equivalent to forty horses, the rolls making seventy to eighty revolutions a minute. The hammers used are powerful, having the surface of the stroke very large —just the contrary shape there to the ordinary tilt-hammer. A gang turns out in a shift from 450 to 500 sheets.

"In the central works, where they make sheet iron from puddled iron, they *roll* it into the necessary size, and then roll this *balvanky* into half-ready sheets with the same sort of rolls as are used in the North, but which however run much slower; the finish being given also by hammers in the same manner, but leaving out the final part of the operation of placing cold finished sheets between the hot unfinished ones. The hammers are not so heavy, and the heating furnaces are not so well constructed and do not regulate the flame as well. The trimming, sorting, etc., are carried out in just the same way.

"The waste is really greater in the Central Works than it *should* be in the North, as the hammered iron does not leave such a raw edge as the puddled.

"A fact that proves the superior manufacture of the North over the north parts of the empire is, that whereas in the former sheet iron is the best paying, in the latter it is the worst business. . . .

"For the uses to which sheet iron is put ductibility is of the first consequence, and no sheet iron is of passable quality that will not bend four times without breaking; some made in the Oural I have bent as many as nine times without showing the break. Coupled with this quality the *glance* must be taken into consideration, as good polished iron will not take so much paint as the inferior polished."—*Bulletin of the American Iron and Steel Association.*

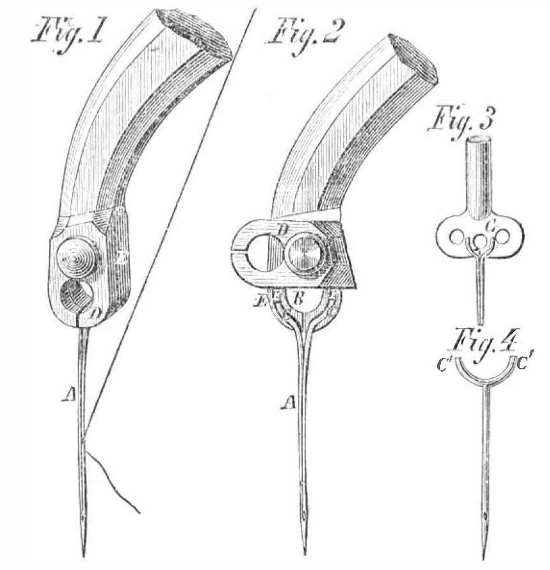
Brave Act of an Engineer.

Chambers' Journal tells the following incident of nerve on the part of an English locomotive engineer: An engine left standing at a station was "thrown out of gear," as it is called —that is, its machinery was so purposely deranged that it could not move in either direction; but, from this having been imperfectly done, it at last got under way, very slowly at first; but the regulator being jerked open, it soon attained a terrible speed, which was all the more alarming, as it had started on the down line, and was running towards London. The effect of this, of course, would be that it must, sooner or later, run headlong into the first down train, and there seemed no possibility of averting a more awful accident than had ever yet taken place. A ballast driver, however (one who has charge of the train of earth trucks which convey the material for making the lofty parts of new lines, and also remove the soil from cuttings), saw the engine running without a driver, and, with wonderful nerve, left his siding, and at full speed dashed after the flying locomotive. This was desperately hazardous, for, had they encountered a train, he would not only have been killed, but, by the presence of his engine, would have rendered the inevitable accident more fearful—the reader, of course, understands that he, too, was running "up" on the "down" line. However he caught the runaway, and leaping from his own engine on to the tender, he reversed both engines and ran back to the station—some six miles—as swiftly as he could, arriving there safely, just in advance of a passenger train.

THE CARPENTER SELF-THREADING AND SELF-SETTING NEEDLE FOR SEWING MACHINES.

Among the many things to be exhibited the Fair of the American Institute, this season, will be the device herewith illustrated. It is the invention of a woman, and displays a a great deal of ingenuity and inventive capacity. The neatness of the device, and its freedom from complications will at once impress practical minds.

The object of the invention is to produce a needle that can be threaded with the utmost ease and facility, and, at the same time, to render it self-setting, so that the difficult and nice adjustment of the needle, now necessary on most of the machines in the market, may be accomplished with the same ease and certainty as is done on the Wilcox & Gibbs machine.



The general form of the needle is shown in Fig. 4. The upper portion is bifurcated as shown at C, and from the middle of the bifurcation the needle is split longitudinally down to the eye, and no further, so that a thread, placed in the fork of the needle, the ends being drawn by the hands and pressed down towards the eye, will pass through between the two divisions down into the eye, when the parts of the needle will close like a spring above it, and hold it from slipping back again.

The end of the needle arm, when made like that on the Wheeler & Wilson machine, is formed as shown in Figs. 1 and 2. A clamp, D, is shown, turned aside, in Fig. 2, to display the manner of inserting the needle. The legs of the fork of the needle are nicely fitted into a groove formed in the end, E, of the needle arm, and when the clamp, D, is is turned back over the fork, as shown in Fig. 1, and a nut, which runs on the pivot of the clamp, D, is turned down, the needle is firmly held in its place. Moreover, it is always held in one place, and the right place, so that it might be inserted in the dark by a person familiar with the adjustment.

The end, E, of the needle arm, and the clamp, D, are both slotted to correspond with the upper part of the split in the needle, A, Figs. 1 and 2, and a hole, B. corresponding to the curve of the forked part of the needle, is drilled through the end of the needle arm and the clamp.

The needle and clamp being set in position, the needle is threaded by putting the thread through the hole, B, the latter being so large that the thread can be put through it in the dark, if desired, the fingers being guided by the sense of touch, instead of sight. The thread is then drawn down through the slots in the end of the needle arm and the split in the needle, and into the eye, as above described.

It is claimed that the increased elasticity given to the needle by this form of construction renders it less liable to break than when made in the old way. In an experiment with one of them, attached to one of the Empire sewing machines, and working upon the heaviest kind of shoes made on that kind of machine, we are told that it made sixty pairs in a single day without breaking or causing any kind of inconvenience. This would seem a sufficient test of its strength, and its convenience when applied, as it can be, to any kind of sewing machine in market, will, we think, be obvious to all conversant with the operation of such machines. By its use, neither the eyes nor the patience of the operator is tried in threading or setting the needle, each of which manipulations may be performed in a perfect manner in a moment of time, by the most inexperienced person.

In shuttle machines, the clamp is made as in Fig. 3, the general principle being the same as in the others.

A reissue of patent on this invention was granted to Miss Mary P. Carpenter, of San Francisco, Cal., May 31, 1871.

Arrangements are being made for the general introduction of the improvement throughout the United States and Europe patents having been secured in all the principal States of Europe. Call upon, or address for further information, the Carpenter Sewing Machine Needle Co., or A. E. & C. E. Tilton, 95 and 97 Liberty st., New York.

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Steamboat Speed.

Messrs. Editors:—In the Scientific American of the 6th inst. your correspondent writing under the above title, after giving the speed of many of the fastest steamboats upon the Mississippi for the last twenty-six years, showing but very little increase of velocity during that time, notwithstanding considerable improvements in the steam engine, asks the very pertinent question: "Is it not because the model, which is nearly the same to-day that it was a quarter of a century ago, is faulty?" Here is undoubtedly the difficulty. The water when moved from the track with a low velocity, interposes but a slight resistance. But the fluid resistance increases at such a high ratio that after a vessel has run up to what sailors call "her lines," thereafter an augmentation of power, as all practical steamboat men know, produces but little more speed. This is as true of the three miles an hour canal boat as the twenty miles an hour North River steamer.

Whilst every improvement in the steam engine and boiler must have an important bearing on steam navigation, the direction in which to look for great and beneficial changes must be the model.

Whilst the general proposition is true that the model that shall force the water out of the track with the least velocity, at a given speed, other things being equal, will produce the fastest boat, there are conditions of speed which this proposition does not embrace, which are scarcely less important. And here is the great problem. What are those conditions, and how are they to be met? I know of but one man who can probably answer these questions.

The books treating upon hydrodynamics and the laws of fluids as they affect navigation have not satisfactorily answered them. He to whom I refer was the designer of the rams *Avenger* and *Vindicator*, of the Mississippi Squadron of the late war. These were built at New Albany, Indiana, in 1863–4 by Messrs. Hill & Pane, ship-builders of that city.

Having been there during a part of the time of their construction, and having seen them in service during the war on the Western rivers, and having conversed a number of times with the officers of the fleet having these vessels in charge, in reference especially to their speed, I am able to state the following facts, which I believe are entirely reliable:

The Government having lost two rams in operations upon the Mississippi, determined to build two more to supply their loss. After plans had been virtually settled upon, a person not claiming to be a ship-builder, but to have made careful experiments in hydrodynamics, and to have given much attention to the subject of the fluid resistances as they affect the movements of ships, suggested to the officers having charge of the construction of these rams that by an alteration in those parts of their hulls which remove from and close the water into their tracks, a very great increase of speed could be obtained, and that, too, without changing their general proportions, altering their contemplated draft, or in any way changing their plans for machinery.

The velocity which had been contemplated for these rams was not over about nine miles an hour. As they were to have great width for their length, and to be with flat bottoms, deep down, on account of their great weight of construction, heavy casemates, and armor.

This philosophical experimenter represented that if they would alter the plan of one of them but a very little in the way he advised, instead of nine miles an hour they would get twelve or thirteen miles an hour out of her; and that if they would consent to the alteration of the other a little more, she would develop a speed of sixteen miles an hour. This would be much faster than the swiftest steamers on the Mississippi when loaded to their contemplated draft. And as these were to be comparatively blunt boats, and to possess no more power than ordinary vessels on the river, of their size, such expectations seemed wild and visionary. But, if his experiments showed what he claimed, and his philosophical demonstrations were correct and his mathematics accurate, then his conclusions, however extravagant they appeared, must follow. No one ventured to dispute his science. But they could discredit his conclusions, and that, we think, they all did. But as these proposed changes would give the Government certainly as good vessels as they had contemplated, and perhaps a little better, and would occasion but slight additional expense, these proposed changes were adopted. Their models, though symmetrical and beautiful, were very peculiar. I shall not attempt to describe them.

But what seemed to surprise every one but the inventor himself was, that when they came to try the speed of these rams they actually ran considerably faster than he had predicted. Questioning him in regard to that, he said that he had promised the Government officials "not as much as he had intended to give them, but more than they would believe," and "that he thought it would be policy, in view of future and higher developments of his theory, to do better than he should promise."

These rams were great favorites with the officers of the fleet. Admiral Porter pronounced the *Vindicator* the fastest of them—not only the swiftest vessel in his squadron (comprising over one hundred vessels) but *unquestionably* the fastest vessel on the Western waters. On account of her great weight the *Vindicator* was always down to a draft of about six feet, and with a bottom entirely flat, except at the ends, she at all times ran in the condition of a loaded boat on the Western rivers. And, although her boilers and engines were only of the size and power of ordinary boats of her class and notwithstanding she carried no higher steam than other boats, it was well known on the river that there were no boats that could beat her. And we see by the great race recently on the Mississippi, between the *R. E. Lee* and the *Cincinnati,* that although they ran light—one of them even refusing to carry passengers—and probably did not draw on the race more than 3½ or 4 feet of water, they failed to come up to the reputed speed of the *Vindicator.* But what would probably her speed have been if she could have been lightened up to a draft of only 3½ or 4 feet? Her inventor claimed that in the models of those rams he was confined to very narrow limits, that he could build boats that, without using more power than other boats of their size and draft, could run as fast again as the *Vindicator.* He contended that the ship-builders were at work in the dark, that they knew not the operation of the laws of fluids in navigation, and that the books which pretended to teach them only misled, that philosophers had made careful and valuable experiments in hydrodynamics, but they had not the wit to understand them.

But why have not these experiments been followed up? Why has the valuable information which dictated the forms of these rams been allowed to sleep? Ideas born before their time die of inanition, and must be born again when the world is ready to receive these young immortals. Surely *this* is not before its time. Is anything more imperatively demanded than rapid and cheap locomotion upon the water?

The inventor claimed that the forms of these rams were suggested by valuable discoveries of his own in hydrodynamics. If so, they ought to be made public. Scientific discoveries belong to the world. What I have stated in reference to the velocities of these boats, can be corroborated by Messrs. Hill and Pane, the builders above referred to by Capt. Selfrage, late explorer of the Isthmus of Darien, who commanded the *Vindicator,* and also by the distinguished commander of the Mississippi Squadron, Vice-Admiral D. D. Porter. Perhaps those ship-builders can explain why those valuable experiments, for those rams were regarded by the inventor as mere experiments testing his theory, have to all appearances stopped there.

I have detailed these facts to confirm the proposition with which I started, to wit: That we must look to better models for better results in velocity than we now have, and also to exhibit a marked success in that direction, which ought to be quickly followed by others. The designer of these rams, undoubtedly went to work in the right way. He sought by careful experiments in hydrodynamics, to understand thoroughly the operation of the laws of fluids as they affect navigation. That here was a proper field of inquiry, was apparent, from the fact that philosophers, experimenters, and writers on these subjects, generally disagreed in their conclusions, and the experience of every day disproved their theories. There seemed but *one* certainty, and that was, that they were *all* wrong. It was stated by some authors, that "the resistance of bodies moved in the water was in the ratio of the square of the velocity"; others, "in the ratio of the cube"; another, "in the simple ratio of the velocity." Therefore, it was first necessary to understand the experiments; those experiments which had not been comprehended. He began by reconciling the apparent contradictions of the experiments *in his own.* These not only showed the truth as it really was, but also how the wrong conclusions had arisen, He then laid down his forms for ships, with the probability that he would not be disappointed in the practical result, and he was *not* disappointed.

It is to be hoped that these experiments in ship-building will be continued either by him, or some other not his inferior in the requisite knowledge. Let his bold assertion be well tested "that ships can be built that can run with more than double present velocities, and with cheapness of movement in the ratio of increased velocity, as compared with other vessels."

This looks improbable, as do all great things, until accomplished; but if achieved, will fairly earn for the inventor high distinction among men, and confer upon the world at large, an inestimable benefit. O. K.

Tin Fruit Cans Once More.

MESSRS. EDITORS:—In your issues of June 18, August 20, and September 3, you have articles discussing the dangers arising from using tin plate for making fruit cans.

The statements made by the first writer may affect injuriously a large trade, and it is important to know if they are true. Here in the West, we make very large quantities of tin fruit cans of what is known to the trade as "coke tin." The iron which forms the body of it is of an inferior quality, but good enough for such cans which are only used once, and one use is all they will stand. I have seen some of them so eaten through by one year's use, that I could wring off the tops at the line showing where the contents reached to.

Charcoal tin, which is, however, very seldom used, I have known to last over ten years, and then would only be discolored, and were thrown away only because very much dilapidated by many bruises.

As to the solder used, we generally make it of half tin and half lead, which is the same, I believe, as that used by Tubal Cain, the first worker in metals. If much more lead is used the solder will not flow, and is more costly than the fine solder, because it takes a greater quantity. Both coke and charcoal tin plates are covered, I believe, with the same coating, tin.

The Baltimore cans, some of them at least, are soldered by a different process from ours, which makes a much stronger seam, and, so far, is better; but in their kind of seam, I suppose they might use a coarser solder; whether they do or not I do not know.

I have never heard of any injury arising from the use o tin cans; and if any hurtful compounds are formed they are so small in quantity that they are not perceived.

Cincinnati, Ohio. H. W. S.

Glass vs. Tin Fruit Cans.

MESSRS. EDITORS:—Seeing an article on page 69, current volume, SCIENTIFIC AMERICAN, by F. M. Mills, calculated, as I think, to mislead persons desirous of canning fruit and vegetables, I will say that my wife has had some eight years' experience, and usually cans from ten to fifteen bushels. We commenced with tin, as all our neighbors had done, first by soldering tops on, then using sealing-wax instead of solder. The tin soon went into disrepute with persons able to purchase better; then came the glazed-stone ware, and glass with tin tops and sealing-wax, and about the same time the glass self-sealers with tin or zinc tops, and lastly the glass self-sealers with glass tops, which are now used in preference to all others, having been used for some three years their advantages have been fully tested. I sell annually upwards of 1,200 at retail, and this season glass takes the place of tin and stone with all who feel able to pay the difference in cost—the glass costing a little over double what the tin costs—while selling 6 dozen each, tin and stone cans, I have sold 50 dozen glass, principally self-sealers with glass tops.

Your correspondent, Mr. Miller, says the tin will not rust with four years' use, and that the fruit retains its flavor one quarter better than in glass cans. His experience must have been with much better tin cans than our tinners make, and very imperfect glass cans. We consider that the glass retains all the original flavor of the fruit, and he admits that the tin does not.

One material advantage the glass possesses with inexperienced hands is, that if the fruit is not properly prepared and sealed, it will show it in a few days after canning, when it may be opened, brought to a boil, resealed, and saved.

Watertown, Tenn. W. L. W.

[Our own experience accords with that of this correspondent. We have had large quantities of fruit put up in glass jars for years, and find that the fruit keeps admirably, without loss of color or flavor, unless set in a light place, in which case its color will turn. For the canning of fruits for market, glass is not so convenient or cheap as tin, but we find it all that is required for domestic use. With proper care, very little loss from breakage will be experienced.—EDS.

Military Telegraphy.

The use of telegraphy in warfare is very ancient; but in the early ages it was limited to signal fires on the tops of hills, and to wooden frames having movable arms. These machines, called "semaphores," were in use down to very recent times. Electricity has, however, nearly superseded all other modes of telegraphy. For military purposes it was first tried on a grand scale during the Crimean war; but field telegraphy was greatly developed during our own civil war.

The military telegraph differs entirely in appearance, though not in principle, from the ordinary telegraph. It has no need, as the latter has, of long wooden posts, with their apparatus of supports for the wires, nor of fixed stations for the manipulation of the electric battery and signals. Its "wants," if one may use the expression, are very simple. It is an ambulating machine, and its wires are laid along the ground, it mattering nothing what the nature of the soil is, whether stony, flinty, grassy, or fallow, or whether it is laid through marshes or rivers or ditches filled with mud. The wire is so made as to be capable of resisting the trampling of horses and the crushing of wheels of the heaviest vehicles on common roads, though not that of artillery or of a railway train. Of late the French military authorities have paid great attention to military telegraphy, and before the war broke out they instituted a series of experiments on it at the camp at Chalons. Lines of wires were laid down in every direction on the public roads, and allowed to remain there day and night for whole weeks at a time, subject to all the passing traffic of horses and vehicles of every description, and to every change of weather, and it was found that notwithstanding all these trials messages could be transmitted with perfect accuracy and facility. The wire with which the experiments were tried, and which is used at this moment by the French, is simply a line about one fifth of an inch in thickness. It is a sort of a miniature snbmarine cable, which, being protected by a strong covering, is capable of resisting the dangers of rupture and crushing, and to the eye of the uninitiated presents the appearance of a thin tarred rope. In the center of it four threads of copper twisted together form the metallic portion which is to conduct the electric fluid, or rather the electric motion. A final spiral of cotton surrounds them; over this is a thin coating of india-rubber, and the whole, wrapped in a species of vegetable hair, is fastened together and held by two ribbons of impermeable stuff. The cable is wound round enormous bobbins, ranged in military line, eight and eight, on special vehicles, and is wound off as the army advances. When it is to be used, one of the telegraphers fixes it on the ground by double nails, resembling hair-pins. But each carriage contains only eleven or twelve hundred yards of cable, and it frequently happens that the message has to be sent to a greater distance. In this case it becomes necessary to unite the cable already laid with that contained in another carriage. The telegrapher, therefore, cuts the ends of each wire, lays bare the copper thread, untwists them in a delicate manner, and then plaits the strands of each cable together, or, as sailors would say, he splices them. And this operation can be repeated as often as need be. As in the French service the rule is to send a train of eight carriages laden with cable with each brigade or division of the army, it is evident that telegraphic communication can be carried on to no greater distance than about ten thousand yards, or not quite two miles. In a great battle extending over several miles, and in operations, such as those now going on, extending over a large area—say forty or fifty miles—these field telegraphs would have to be very numerous in order to keep up communication with all points of the line. While the cable is being laid, the electric apparatus is in the first compartment of the first carriage, in charge of the chief telegraphic operator, who works it from the moment the cable starts to the time when it reaches its destination. In this way it communicates to the station of departure, with which it is in constant correspondence, such information as may be picked up in its progress—such, for instance, as the sudden appearance of the enemy in an unexpected quarter, or the discovery of obstacles to the march of the troops, owing to the peculiar configuration of the country, and the like.

A Projected Meteorological Investigation on Mount Washington.

Prof. J. H. Huntington, who spent the last winter on the summit of Moosilauk, now proposes, in the interest of science, and with the aid and co-operation of the friends of science, to spend next winter on Mount Washington. That the expedition may be furnished with all the needed comforts of life, the proper instruments, and the means of communication with the outer world by telegraphic cables, it is proposed to raise by subscription the sum of two thousand dollars, the same to be expended under the direction of the above-named gentleman, in connection with the State Geologist. It is believed that with this sum the expedition can be made a success, and that the public can read every morning reports of the weather from a station more than a mile above them in the air, and thus hear of experiences similar to those reported by the Arctic explorers. These on Mount Washington can be reported to every fireside within twenty-four hours from the occurrence, while we must wait months and years to hear of no more wonderful experiences from the frozen north. Subscriptions are solicited from all friends of scientific research and mountain exploration. The amount of subscription will not be called for before October 1, nor then, unless the whole sum is raised. To all who present to the cause ten dollars and upwards, a pamphlet describing the history and results obtained by the expedition will be sent, as soon as practicable, in 1871. Subscriptions may be sent to Prof. C. H. Hitchcock, Hanover, N. H.

NOVELTY IN HORTICULTURE.—Mr. A. C. Chamberlain, a practical gardener, of Newport, R. I., left at this office a few days ago a novelty in the fruit-growing line. It was a peach tree growing in a wire frame about the size and shape of a large dog-muzzle. The tree was laden with ripe fruit grown entirely from the soil incased in the cage, which is kept suspended from the ground. Mr. Chamberlain has become famous for producing dwarf fruit-bearing trees, and supplying them in the form of hanging baskets, and the specimen tree referred to is not unlike others he is prepared to furnish from his nursery.

◆

NEW CITY HALL, SAN FRANCISCO, CAL.—The Commissioners who have in charge the erection of the new City Hall building at San Francisco, request the competing architects to send along with each design and plan, the motto and the name of the author, with references, inclosed in a sealed envelope, addressed to the Board. It is the intention of the Commissioners to award the position of Superintending Architect to the author of the accepted plan, if he is, in their opinion, competent and otherwise acceptable. For the authorized notice to this effect parties interested will apply to Wells, Fargo & Co.

◆

A NEW BLASTING POWDER.—M. Bragere recommends a blasting powder composed of picrate of ammonia and saltpeter, 54 parts of the former and 46 parts of the latter. It is stated to be superior to the ordinary powder in the following particulars: It is composed of crystalline bodies easily obtainable in a state of purity; it is less hygroscopic; weight for weight, it is more powerful than ordinary powder; during combustion it gives off only a cloud of vapor of water, free from odor, and the residue is smaller, and consists exclusively of carbonate of potassa.

◆

THE coming total eclipse of the sun (December 22) will be observed carefully in Europe. Our Congress devoted some $30,000 to pay the expenses of parties to be sent abroad, and three expeditions, one under Professor Pierce, another under Professor Winlock, and the third under a naval officer, will be sent.

◆

NEW USE FOR HYPOSULPHITE OF SODA.—It is said that experiments made with this salt have proved it to be very superior for use for washing linen to the carbonate of soda now in use; it has no corrosive action, and does not cause a yellow coloring of the fabrics after some time. Borax, largely used in the Netherlands and Belgium, is a better substitute still, and, by its use, white fabrics assume an agreeable bluish hue, which, in many instances, renders the subsequent use of washing blue unnecessary.

◆

CANADIANS can now apply for patents in the United States upon the same terms as citizens. Full information can be obtained by applying to the publishers of the SCIENTIFIC AMERICAN.

◆

WE would call attention to the advertisement of Geo. H. Holloway, on another page, who offers his services to introduce useful inventions in England. Mr. Holloway has had great experience in introducing American inventions abroad.

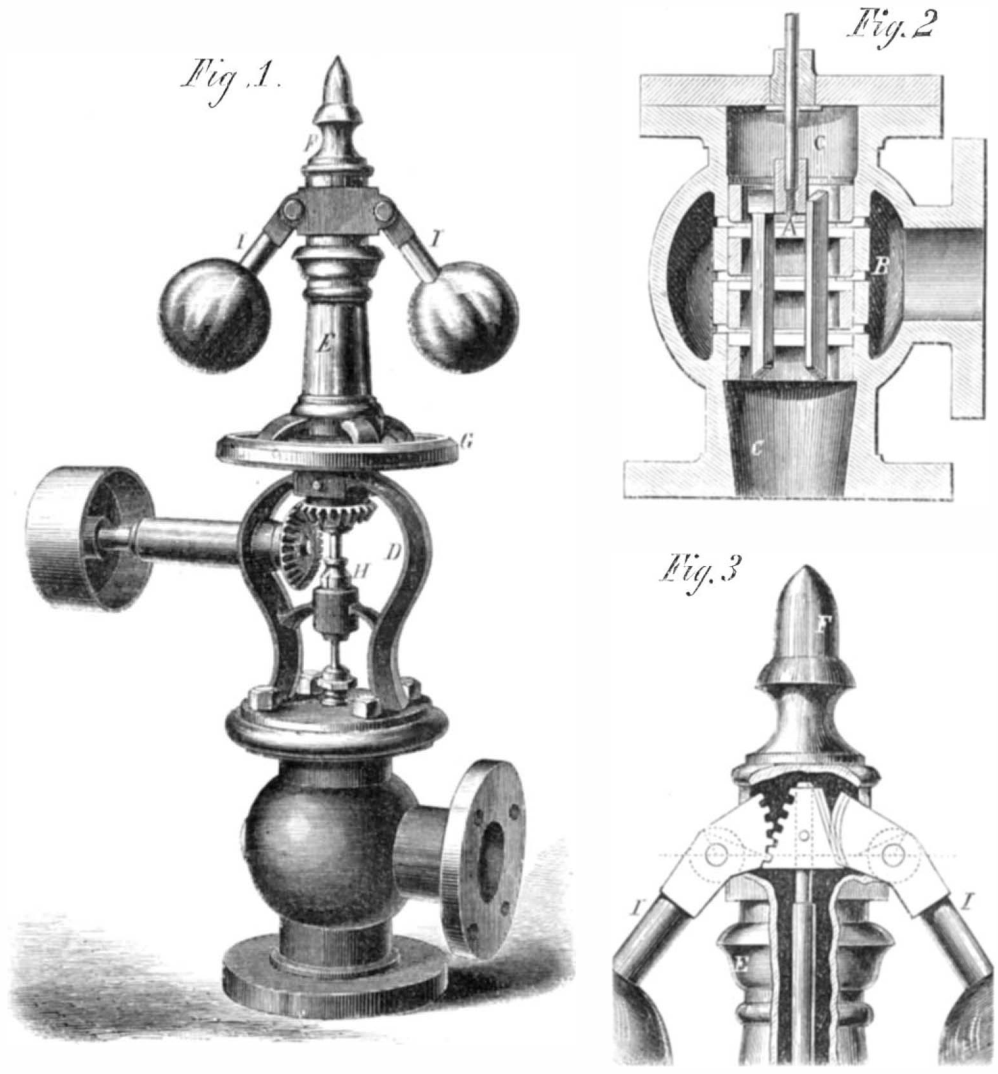
Improved Steam Governor.

One would think, from the great variety of steam governors and regulators in market, that the art and true principles of governing steam and regulating steam engines have been reached and brought to perfection, and that the field for further improvement has been well nigh exhausted. But the keen observer, and the experienced engineer, as well as the manufacturer who is affected by the need of perfect motion and regular speed of machinery, know that there still lies open a great want for improvement, yet unattained in the steam governor.

It is well known to those conversant with steam, its subtile nature and its application to power, that there are many difficulties and obstacles to encounter and to overcome in obtaining uniform motion, and to compensate for the ever-varying powers required from the steam engine. Inventors have brought forward numerous combinations of improvements many of which embrace radical points of convenience and novelty, but which are more or less actuated by auxiliaries, such as weights, levers, or springs, to compensate for the seeming imperfections in their principles and their application, thus rendering them more or less complicated with a multiplicity of parts, making them difficult to adjust and operate, and lessening their reliability and durability.

It has been found by practice that the centrifugal ball principle is the most reliable means to show variation of speed, and that when applied to a properly constructed cut-off valve it gives positive motion to it, thus setting it perfectly. It is well known that, however perfect the governor is in construction it becomes of little use when applied to an imperfect valve used for regulating the steam in its action, and that one of the great considerations of a perfect regulator consists in a perfectly constructed cut-off valve combined with the governor, which thus gives great sensitiveness of action and a uniform speed to the engine.

Our engravings represent an improved governor and cut-off, claimed to possess all the above requirements, and it will be seen that there is an entire absence of annoyances resulting from the use of weights, levers, and springs, etc., that complicate a governor.



CONDE'S IMPROVED STEAM GOVERNOR.

Fig. 1 is a perspective view of the governor and valve, Fig. 2 is a sectional view of valve and chamber, and Fig. 3 a sectional view of revolving head, showing graduation or increasing travel of the valve. The valve, A, Fig. 2, consists of a series of rings secured by internal ribs, thus forming ports for admitting steam from the chamber, B; this valve slides in a chamber, C, having ports corresponding to those in the valve, and the rings forming these ports are stayed by ribs on the outside corresponding to those in the valve. As the valve is moved longitudinally in its seat, it will be seen that the steam from the chamber, B, may be entirely cut off by its movement in either direction, and, that being surrounded by steam it is perfectly balanced, and works without pressure to retard its motion. The valve also acts as a stop in case of any accidents; for when the valve rod is connected to the governor-balls, the expansion of the balls throttle the steam as the valve is then given a downward movement, and should the governor belt break or fly off, causing the governor to stop, the balls would of course drop, which would cut off the steam by an upward movement of the valve, thus forming a perfect automatic stop.

D, Fig. 1, is the stand of the governor which rests on the valve chamber, and on which all the working parts of the governor rest. E is an adjustable sleeve through which the spindle of the revolving head, F, passes, and to which it is secured by a collar on the spindle within the upper part of the sleeve. The sleeve, E, is united with the stand, D, by a screw connection, and acts as a support to the upper portion of the governor.

The sleeve is raised and lowered upon the frame by the screw through the compensating wheel, G, and thereby the cut-off valve and the flow of steam are regulated. H is a swivel working in a guide cast on the frame, and having within it a hardened swivel block working upon hardened steel plates. This swivel connects the valve stem with the rod that passes up through the spindle and connects with the wedge block within the head, F, as shown in Fig. 3. This swivel has a slot on the side in which a feather fastened in the guide works, and prevents the swivel from turning, taking the strain off the valve stem.

The spindle of the revolving head connects to the sleeve by a collar, and passing down through the upper part of the frame, connects with the miter gears by a feather and groove, so that it may be readily raised and lowered for regulating the valve without disturbing the driving gear.

The head, F, is fitted with a novel movement, as shown in Fig. 3, by which graduation is effected. The ball arms, I, are connected to the head by pins in the usual manner. These arms have cam-shaped ends, having teeth cut in their periphery, which gear into the wedge block fastened to the valve rod. As the balls expand from centrifugal force, the cams are increasing their leverage in their downward movement, giving increasing travel to the valve, and compensating for the increasing force required to hold the balls as they approach a straight line.

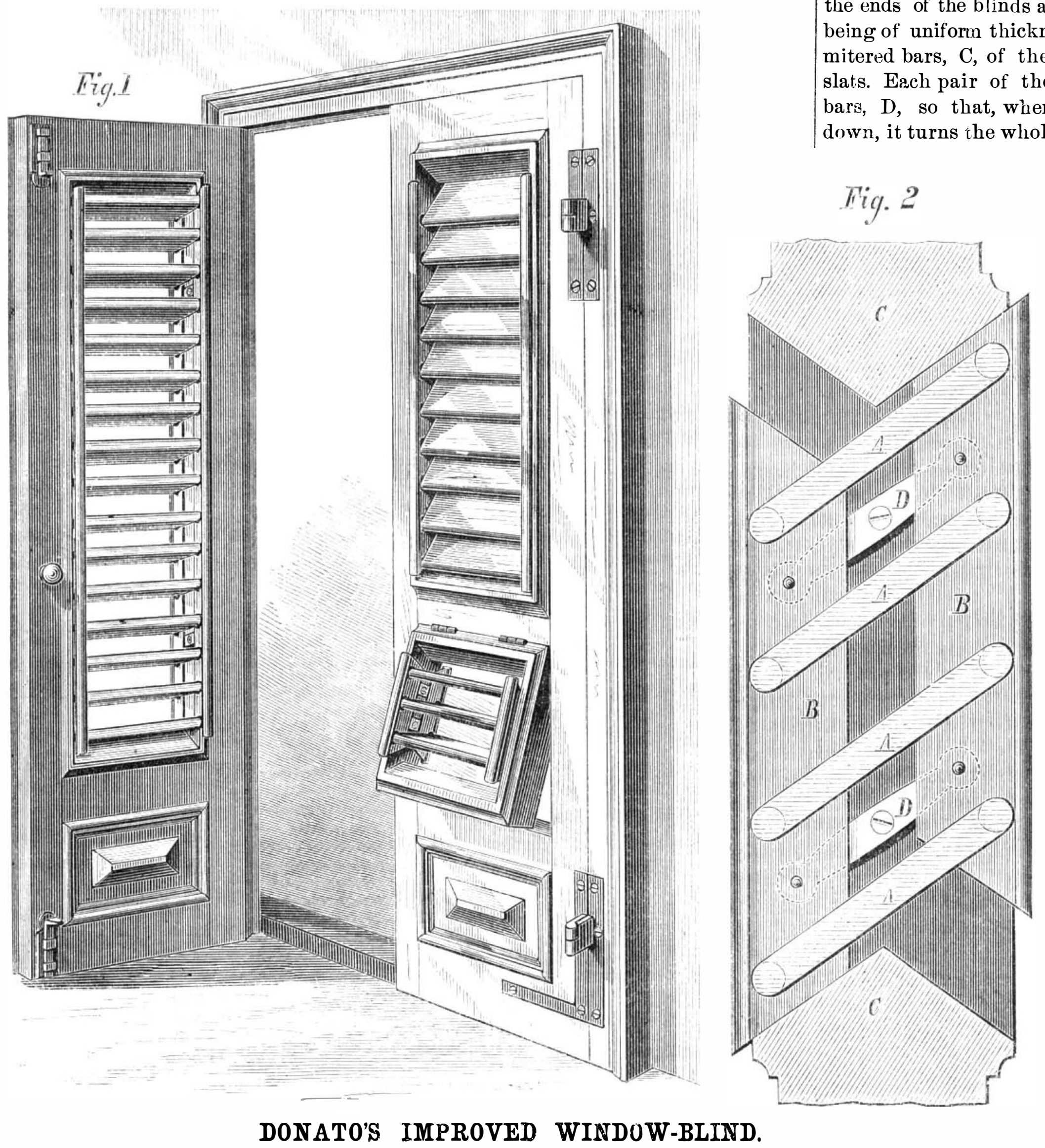
The operation of this governor is very simple, and it has full control of the engine at all times, the position of the valve is such that when the compensating wheel is at its lowest point (the balls being down), the valve presents a half-open port, thus admitting steam sufficient to start the engine, which will run slow until the compensating wheel is raised, thus bringing the engine gradually up to its speed, and, at the same time, setting the automatic stop, so that in case of accidents from the belt breaking or other cause, the balls drop, raising the valve, and cutting off the steam without increasing the speed.

The inventor states that the accuracy with which this governor regulates engines performing the most variable work, as in rolling mills, saw mills, etc., is unexcelled.

It is secured by several patents taken out through the Scientific American Patent Agency, and is manufactured by the inventor, C. A. Condé & Co., at the American Governor Works, Indianapolis, Ind.

* * *

Improved Window-Blinds.



DONATO'S IMPROVED WINDOW-BLIND.

Our engravings illustrate a simple and useful improvement in the construction of window-blinds, whereby if any of the slats become broken or any other of the working parts need repair, they may be replaced without taking the frame apart, and without injury to any other part. As window-blinds are ordinarily constructed much trouble is experienced in making such repairs.

The method of pivoting the slats illustrated herewith does away with all this inconvenience, and, at the same time, gives a more finished and elegant appearance to the blind. It also makes tighter joints at the ends of the slats to exclude wind and rain.

The method of pivoting the slats is shown in Fig. 2, in which A represents the slats, each having two tenons formed on each end. These tenons play in holes formed in two vertical bars, B, placed on both sides of the series of slats. These bars are formed with beads or moldings on their outer edges, the thinner part which plays under the ends of the blinds and into which the tenons are inserted, being of uniform thickness and mitered at the ends to fit the mitered bars, C, of the frame above and below the series of slats. Each pair of the vertical bars is hung upon rock-bars, D, so that, when either of the bars is moved up or down, it turns the whole system of vertical bars and slats.

The pivots upon which the rock-bars, D, play are screwed into the frame, and when withdrawn the entire system of slats and vertical bars can be removed from the frame, and others can be inserted for such as have been broken.

The blind is of elegant appearance and is well adapted to inside use. The bars, C, may, when desired, be covered and concealed by ornamental moldings. Mosquito nets may also be attached to these bars on their inner edges without interfering with the motion of the slats.

Patented, June 7, 1870, by Thomas Donato, through the Scientific American Patent Agency. Address the patentee for further information, at No. 429 East Fifteenth street, New York city.

* * *

Fatigue to the Eyes caused by Artificial Light.—The great difference between the sun and artificial light is due to the fact that, of the light emitted from the former, about half the quantity of rays are luminous and calorific at the same time; but as regards our artificial light, for ordinary oil, the amount of non-luminous, yet calorific rays is 90 per cent; for white hot platinum 98 per cent; alcohol flame, 99 per cent; electric light, 80, and gas light, 90 per cent; while for petroleum and paraffine oils, the amount is 94 per cent. It is this large quantity of caloric rays in artificial light which causes fatigue to the eyes; but this inconvenience may be almost entirely obviated by intercepting the thermic rays by glass, or, better yet, mica plates. The use of these renders the light soft and agreeable to the eyes.

Scientific American,

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NEW YORK, SATURDAY, SEPTEMBER 10, 1870.

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Contents:

(Illustrated articles are marked with an asterisk.)

To Advertisers.

The circulation of the SCIENTIFIC AMERICAN is from 25,000 to 30,000 copies per week larger than any other journal of the same class in the world. Indeed, there are but few papers whose weekly circulation equals that of the SCIENTIFIC AMERICAN, which establishes the fact now generally well known, that this journal is one of the very best advertising mediums in the country.

SOCIAL CLASSIFICATION.

The idea of distinction of classes in society was, in the early history of our country, specially abhorrent to the average American mind. Not that American society had rejected class distinctions, but that, in the condition of the people—by far the greater number of whom were small farmers, laboring with their own hands for a frugal subsistence—these distinctions were not so prominent as now, and the common struggle for existence, as a Nation, obscured, in some measure, the lines of demarkation which existed then as now.

The wealthier and more cultivated families were scattered here and there, at wide distances, which rendered constant intercourse with each other difficult, with the then imperfect facilities for travel and communication. These families were each a sort of social nucleus, around which clustered the poorer classes, and the head of each was more or less looked up to for advice, and even assistance, repaid by the tributes of minor services, and, often, personal defense in case of danger from savages.

A tender and affectionate relation between the wealthier class and the poorer portion of the population, growing out of this intercourse and exchange of services, helped to conceal the real distinction which exists between the rich and the poor; a distinction not essentially elevating to the one or degrading to the other, but a distinction nevertheless, which always has existed and always will exist, under the present organization of society—the power of the one to live in a style impossible to the other.

The word "aristocracy" has been hateful to the minds of people, who could not attain to the aristocracy of wealth or mind, the only aristocracy which American society, in the opinions of some, renders possible. But though we have no orders of titled nobility, we yet have an aristocracy of birth for all that, and these class distinctions are daily becoming more and more defined. It is, moreover, not true that American aristocracy is, as a popular satirist has sung, a "thing for fleers and jeers;" it is a reality not to be ignored, any more than the realities of monopolies or political rings. It is a fixed fact.

Now let us see how the people of small means regard this aristocracy. Decidedly as a thing to be envied and imitated. To the utmost of their hard-earned resources do they ape the airs, and mimic the manners of the wealthier classes. The mechanic's wife, riding to the Park in a hack hired in the Bowery, throws herself back with imagined grace, and flutters her fan, as she fancies some admiring looker-on will deem her richer than she really is, and tosses her head as she steps therefrom to partake of a sandwich at some up-town restaurant. The hard working mechanic finds that the necessities of dress for his family, furniture, house rent, etc., draw heavily on his earnings, thinks his wages too small, clamors loudly for more, and strikes if he does not get it.

Is this not a true picture? Are not the hardships which mechanics and laboring men and women feel, in great measure due to a vain struggle to hide the line of demarkation which divides the affluent from the poor.

We are far from saying that these classes in society are, in our opinion, the highest type of social organization, but we do say that, in such an organization as we now live under, they are not only inevitable, but even more desirable to the poor than the rich, would the poor accept them as inevitable, and cease their aspirations to be thought what they are not. Neither would we in any way limit the opportunities of the working classes to rise to affluence, and attain the social position which wealth secures. Many of those who now occupy high social positions have risen from their ranks, but few such cases can be found, where rigid economy and full acceptance of the fact, that it is folly to imitate wealth while poor, gave not the first accumulation through which subsequent wealth was attained.

Every person of limited means, who aims at display not justified by his resources, not only commits a fraud but tacitly acknowledges his poverty a disgrace. Class distinctions, if accepted here as in Europe, would greatly improve the condition of the working class under present *regime*. If a man is a working man, why should he be ashamed of it? Why should he not dress like a working man? Why should he sigh for a broadcloth suit, patent leather boots, and the luxuries which only the wealthy can afford? If these things added to his personal comfort, there would be good reason for his longing, but they don't. His calf boots are just as comfortable as the patent leathers. His cassimere coat is as warm as the finest broadcloth. But it is not comfort he is after, it is concealment rather.

We believe that if the workingmen of America would simply assert themselves as a class, unashamed of what calls for no blush upon the cheek of a sensible man, renounce all attempt at vain display, and go in for solid comfort, they might, with their present wages, be as happy and contented a set of people as the earth contains.

In this connection, we call attention to a series of articles now being published in this journal, on the condition of the working man in various parts of Europe, which will be found both interesting and instructive.

INFLUENCE OF SOUND UPON RAIN.

A French *savant* maintains that it is in our power to produce rain at any time when the wind is in the right direction and there are clouds of vapor in the sky. The proper direction of the wind must be determined for each place by experiment, and the condition of the sky must be studied before attempting to hasten a rain-fall by any particular sounds, such as the ringing of bells or the firing of cannon. During the siege of Sebastopol, as soon as the cannonading commenced, the sky was overcast, and a fine rain began to fall, which was sometimes followed by violent storms and whirlwinds.

As a consequence of the atmospheric changes, the mercurial column in the barometer commenced to vibrate, and it was possible to represent on a chart the exact state of the siege by giving the hight of the barometer at all hours of the day. Whenever there was a truce of a few hours for the burial of the dead, the change in the hight of the mercury at once indicated it.

It has been found that the explosions of powder magazines and the heavy blasts of mines, as well as the violent ringing of bells, have brought on a sudden fall of rain. In some instances the striking of a clock in the tower of a church indicated the exact hour of the commencement of the storm. Whether this was an accidental coincidence or attributable to cause and effect, it is difficult to say.

It was found by the same *savant* that of one hundred and thirty-three rain-falls seventy-six commenced at the sounding of the hour by the church clock; forty-two at the stroke of the half hour, eight at the three quarters, and seven at the quarter.

In large cities the varieties of sounds produce opposite effects, and may neutralize each other, and it is difficult to to study the phenomena; but in small town, if we notice the commencement of the rain, is said that it will coincide with the stroke of the clock.

The explanation given is, that the vapor of water is formed of myriads of globules similar to soap bubbles, which burst when the percussion of the air is excessive, and thus run to water and produce rain. When the sky is overcast with such vapor, if we fire a cannon the equilibrium is destroyed, the globules burst, and the rain falls. If, however, the sky is clear, the discharge of cannon cannot cause rain, as there is none in the sky to be made to fall—but the vibrations in the air may affect some distant place where the clouds are already charged with vapor.

During the Crimean war, in Italy, and in Bohemia in 1866, it was observed that a rain storm attended nearly every battle. At Solferino there was a heavy storm of hail and rain between 4 and 5 P.M., which obliged the French to cease fighting, and thus probably saved the Austrian army.

M. L. Maout, who has studied this subject more than any other writer, recommends the systematic establishment of meteorological stations in communication with each other, to be provided with cannon of suitable caliber, and, when the wind is in the right direction, to hasten a rain-fall, or to drive the clouds to an opposite direction if a continuance of dry weather be desired.

He firmly believes that it is in our power to control the elements sufficiently to do all this. It is easy to criticise and find objection to the theory, but the best way would be to try the experiment. We read that in the present unhappy war in Europe the troops have suffered greatly from rain; and as the cannonading was kept up for nearly a week, there may be some connection between it and the condensation of moisture. The fact that great battles are often attended by rain has been observed since remote antiquity, but no one has attempted to draw any conclusion from this circumstance, or to make any practical application of it. We also know that the guides in Switzerland interdict all talking, singing, or even whistling, when a party is ascending a mountain, as any sudden vibration in the air produced by the least sound is often sufficient to start an avalanche that could sweep away the whole company in a moment.

In view of such facts and observations it may be well to give the subject more attention than it has hitherto received Meteorology is one of the most backward of our sciences, if it is worthy of being called a science in its present crude state. Observations with the barometer, thermometer, hygrometer, and other instruments are made at a large number of stations in the United States and forwarded to the Smithsonian Institution, and are published by the Agricultural Department of Washington every month; but no attempt is made to compare, classify, and systematize them, and they are of little value.

We have in the Museum of the Central Park of New York city, self-recording instruments, and a most admirable system of observations, under the control of Mr. Draper, which could be made of great value if the charts were published and the observations compared with those taken in other parts of the country.

In England a practical application of the observations is made by sending storm signals to the coast, but we have never heard of any attempts to "sow the wind and reap the whirlwind." It is also proposed in the United States to have storm stations established along the coast to warn our ships of danger.

As soon as the observatories are established a more careful study of the causes of storms, especially of rain, ought to be made, and if sound has anything to do with them, we ought not to be long in ascertaining the fact. The whole science of acoustics is one that has been more neglected than any other department of physics; but recently Helmholz and Tyndall have devoted more attention to sound, and important progress has been made in our knowledge of it. The manufacture of all kinds of musical instruments has greatly improved, and the application of sound to flames shows how it may be possible to make a record of each note very much as a photograph is taken of a picture.

That we shall at some future period arrive at an exact knowledge of storms and be able, in a measure, to control them, seems highly probable. If they can be influenced by sound, and we can at pleasure bring down the rain by a discharge of artillery, it would be a far better use of cannon than to devote them to the slaughtering of human beings in war as has been too long done by the various nations of the earth.

The discovery of a way by which sound could be devoted to the production of rain would not be any more wonderful than many of the triumphs of science that have been witnessed this century. The subject is worthy of the attention of our scientific men, and it is to be hoped that their investigations will ultimately be crowned with success.

CONCRETE PAVING.

The numerous failures attending the experiments in concrete paving in this country, more especially where tar has been an element in the composition, have induced a general skepticism in the public mind which it will take some brilliant successes to overcome. It may be said that every pavement employing crude tar in its construction has proved a failure when employed for heavy traffic. Many of them make good sidewalks and paths for pleasure grounds, but as a rule the severe trial of horses' feet and truck wheels soon pounds them into dust, and so thoroughly disintegrates them that the public will not endure them. Most of this class of pavements are, moreover, so expensive of time in their construction, and blockade the streets so intolerably long before they are fit for travel that people will always hesitate to accept this inconvenience for the sake of any promised advantage such pavements can offer.

But, because concrete paving has failed to the extent indicated, it by no means follows that the coming pavement will not be a concrete. In fact it appears to us that some sort of concrete is the most probable thing upon which we shall finally settle, as combining more advantages with fewer drawbacks than any other surface.

Meanwhile the wood pavements will perform the useful function of teaching intolerance to the barbarous cobble-stone pavement and the almost equally barbarous Belgian, Russ, and other stone pavements which have evidently had their day, and must now make room for worthier successors.

The mistake of most of the inventors who have devised tar mixtures for road surfaces has been, it would seem, the idea that all that is needed to imitate the Seyssel asphalte—now so famous as a paving material in Europe—was to mix with coal tar or any similar substance enough of some dry pulverulent mineral, as coal ashes, lime, etc., to give it consistence. Even pine tar has been thus used—as witness the late Fifth Avenue abomination in this city—regardless of the fact that when exposed to the air it eventually becomes resinous and brittle, and will pound up like common resin into a most disagreeable, and, to everything capable of being injured by dirt, destructive dust.

The results of such experiments show that they were performed in the crudest possible manner, unguided by scientific knowledge of the materials used, and also that little or no attempt has been made to so modify the character of pitchy substances by chemical action that they should resemble the only substance of the kind yet extensively used that can answer the requirements of road making.

We have before expressed the belief, and we have yet seen no occasion to doubt its soundness, that an artificial asphalte, as good for road making as the Seyssel, can be made at a cost within limits which will permit its extensive use for paving. Nay, we even go further, and avow that a better material is within the possibilities.

What are the requirements of a concreting substance that shall bind together broken stone or pebbles so as to make a good road surface? They may be very briefly summed up:

Imperviousness to water, unchangeability under the action of air and moisture, toughness, strength, elasticity, and the power of hardening quickly. These positive qualities are essential, and besides it ought not to smell so badly as some of the cataplasms which have been spread over some streets in this city and Brooklyn.

Now, neither coal tar nor pine tar in their natural state at all meet these requirements. That they may be made to do so, however, by chemical changes within reach of modern science, and admixture with suitable materials, we fully believe; and we also believe that notwithstanding the failures experienced in the use of these materials, they will yet be made the basis of a better road system than has yet been seen.

DESTRUCTIVE ACTION OF ILLUMINATING GAS ON VEGETATION.

In a suit brought by the city of Aix-la-Chapelle against the gas company of that town for damage done to the public trees by the leakage of gas from the street mains, the question arose what particular constituents of the illuminating gas was the most destructive. The subject was referred to Prof. Freytag, of Bonn, as an expert, and he at once instituted a series of experiments with various gases to decide the question. A system of lead tubes, perforated with small holes, was laid underneath a plot of ground, in which there was wheat, rye, rape-seed, and barley. As soon as this vegetation was well under way and flourishing, 100 liters of hydrogen, 100 liters of light carbureted hydrogen, and 100 liters of heavy carbureted hydrogen were uninterruptedly conducted through the pipes, under different parts of the beds for six days without the least effect being perceptible.

The same result was obtained when the city gas of Bonn, after being thoroughly purified, was passed through the tubes, but whenever the gas contained tarry matters, especially carbolic acid, the destructive action soon became apparent. The condensed particles of tar could easily be discovered in the earth and about the roots, which they coated and destroyed.

Prof. Freytag, as the result of his observations, expressed the opinion that the normal constituents of illuminating gas exercised no bad effects upon vegetation as long as air and oxygen can get access to the roots—that is, the various constituents of the gas had no worse effects than the nitrogen of the air; but, on the other hand, the gaseous vapors of tar, especially carbolic acid, in consequence of their condensation and accumulation about the roots, are highly destructive to trees.

As it is nearly impossible to free the gas of these foreign vapors it is safe to assume that illuminating gas is destructive to trees, and ought not be conducted in pipes near their roots. The experiments of Prof. Freytag also show that it is unsafe to use too much carbolic acid and other similar agents about trees for the destruction of insects, as there is danger of destroying the trees at the same time.

BOILER INCRUSTATIONS.

The loss entailed by the formation of incrustations in boilers has been the occasion of much scientific research, and efforts have been made to discover a remedy that would be applicable in all cases; and although not a year elapses in which there are not several new powders offered to the public as panaceas for the evil, it must still be admitted that we are far from having solved the difficulty.

Sometimes the agent proposed is too expensive, but more frequently it does not work; and practical men, after having been repeatedly deceived, have become very skeptical, and are slow to admit the value of any new claimant upon their favor, Numerous analyses of incrustations have been made, which show a considerable diversity of composition, but, in the main the deposit is found to consist of sulphate and carbonate of lime, and when the amount of carbonate of lime reaches 20 to 25 per cent, there is great difficulty in removing the incrustation.

It may be well to review some of the anti-incrustation remedies recently proposed and to leave engineers to decide upon the proper one to adopt to suit each particular water, for it is not probable that any one agent will be found applicable in all cases.

In Cassel, Germany, a small quantity of fine, white clay, added to the water, was found to remain suspended in it, and to carry off the other mineral matter in the form of scum, so as to effectually prevent incrustation, as it could be easily blown out with the steam. There are numerous deposits of of clay and kaolin in this country, and it may be worth while to try the efficacy of this simple remedy.

Popper has invented a mechanical contrivance, by means of which he not only economizes fuel in getting up steam, but also prevents the formation of incrustations. It consists of an apparatus with double walls and a canal for receiving all the bubbles of steam in the upper part of the boiler, and the current thus kept up carries all mineral particles into the still water of the appliance, where it settles down as a slimy mass, and can be easily removed. It is claimed that the invention can be applied to any form of a boiler, and that it is very efficient in its operation. It is very favorably mentioned by Fairbairn and other authorities. We have in this case the accomplishment of the result by mechanical, and not by chemical means.

Another mechanical contrivance, invented by Forster, in Augsburg consists of a cast iron cylinder, with wire netting, which is suspended in the boiler. From the bottom of the cylinder is a tube, communicating with the outer air, through which, when the stopcock is opened, the slimy deposit is blown by the steam. A diagram would be necessary to give an exact idea of the contrivance, which is said to answer a very good purpose.

E. Weiss, of Basel, Switzerland, offers a powder under the trade name of "Lithoreactive," which, it is claimed, decomposes old incrustations, prevents the formation of new ones, dissolves the oil and grease from the condensers, and neutralizes the acids that are apt to corrode the engine. It is composed of molasses or sirup, 5 parts; milk of lime, 15 parts; and caustic soda, of 34° B., 80 parts. The inventor says that it at once precipitates all of the carbonates and sulphates, and silica, saponifies the oil and fat, neutralizes all acids, removes, in a short time, all deposits, and does not in the least attack the iron or copper of the engine, and it operates as effectually in cold as in hot water, and can therefore be applied in the reservoirs. The object of adding the molasses is, that it unites with the lime liberated from the sulphuric acid, and forms a soluble saccharate. Two pounds of the lithoreactive is said to be sufficient for 1,800 gallons of hard water. The materials are expensive, but it may be worthy of a trial.

J. J. Allen, of Philadelphia, proposes the use of liquid hydrocarbons, to loosen old incrustations and to prevent the formation of new ones.

Crude petroleum can be used in the following way: Into the empty and cold boiler a certain quantity of petroleum is poured, and the water then slowly admitted. The oil rises gradually to the top and acts, in its passage, upon the incrustations.

In addition to the remedies named above, could be given numerous powders, sold under fancy names, all of which have have been analyzed, and found to contain some constituents that might serve a good purpose, associated with others that would be likely to do more harm than good; but to use these powders indiscriminately, without an acquaintance with their composition or a knowledge of the construction of the water to be acted upon, would be much like taking the same medicine for all diseases without so much as glancing at the label. Different waters require different treatment, and an intelligent engineer will, generally, have to invent a remedy to suit his own case. It is well, however, under all circumstances, to have an accurate analysis made of the water and of the incrustation, and to apply the preventive accordingly.

AS REGARDS PROTOPLASM.

When Professor Huxley delivered his famous lecture on the Physical Basis of Life, we doubt very much that he anticipated the sensation he was preparing for the scientific world. A general attack, all along the line, from the orthodox, reinforced by those who usually fight under the colors of materialism, has been the result. Professor Huxley, while laying no claim to orthodox belief, distinctly declares he is no materialist.

His claims for the substance called protoplasm are not, if we understand him, that it is the *sole* basis of life, but that it is the ultimate physical basis, that life first becomes obvious in this substance, and that it passes through various forms of vegetable life, each form appropriating it to itself, and that its characteristics are the same in each.

There can be no objection on the part of any to admit that matter plays its part in the concurrence of phenomena which is called life. The supposition that some combination of elements may be the one common physical basis of life is, however, more difficult to accept, and Professor Huxley's assertion, that in protoplasm is found this common basis, has, therefore, naturally met with discredit from men of high scientific character, as well as much senseless denunciation from those who supposed its acceptance would strike at the very root of orthodoxy.

Among those who have rejected Professor Huxley's views of protoplasm is Mr. James Hutchinson Stirling, of Edinburgh. A paper read by him at a *Conversazione* of the Royal College of Physicians of Edinburgh, in April, has been republished in this country,* in which Mr. Huxley's views are attacked from a scientific standpoint.

In an article, reviewing Mr. Huxley's essay, on its first appearance in the English journals, our readers will remember a statement of the composition of protoplasm, namely: Water, carbonic acid, and ammonia. It is the combination of these substances which is asserted to be, not the origin of all living things, as Mr. Stirling puts it, but the common *physical* origin of all living things. It is an unfair inference, in our opinion, to draw from Mr. Huxley's remarks, that he means anything more than this. We do not infer that he supposes that protoplasm accounts for all the phenomena of life, and in his broad assertion that materialism involves "grave philosophical error," he seems to anticipate the possibility of such an erroneous inference.

As for the conclusion of Mr. Stirling, derived from Mr Huxley's reasoning, that "he will lay out all our knowledge materially, and we may lay out all our ignorance immaterially—if we will," we are willing to accept it to the full. All our knowledge, in a scientific sense, is based upon materialism, and ignorance has, in all ages, found its expression in the blind faith of immaterialism.

But we pass to the real scientific objections to the assertion that there is a common universal matter of life. These are given in a very clear and concise manner by Mr. Huxley's reviewer. We can find space only for the following, among others worthy of note, and, as we cannot hope to condense more than Mr. Stirling has done, we shall quote the passage entire:

"Even should we grant in all protoplasm an identity of chemical ingredients, what is called *Allotropy* may still have introduced no inconsiderable variety. Ozone is not antozone nor is oxygen either, though in chemical constitution all are alike. In the second place, again, we say that, with varying proportions, the same component parts produce very various results. By way of illustration, it will suffice to refer to such different things as the proteides, gluten, albumen, fibrin, gelatin, etc., compared with the urinary products, urea and uric acid; or with the biliary products, glycocol, glycocolic acid, bili-rubin, bili-verdin, etc.; and yet, all these substances, varying so much, the one from the other, are, as protoplasm is, compounds of carbon, hydrogen, oxygen, and nitrogen. But, in the third place, we are not limited to a *may say;* we can assert the fact, that all protoplasm is not chemically identical. All the tissues of the organism are called protoplasm by Mr. Huxley; but can we predicate chemical identity of muscle and bone, for example? In such cases Mr. Huxley, it is true, may bring the word 'modified' into use; but the objection of modification we shall examine later. In the mean time, we are justified, by Mr. Huxley's very argument, in regarding all organized tissues whatever as protoplasm; for if these tissues are not to be identified in protoplasm, we must suppose denied what it was his one business to affirm. And it is against that affirmation that we point to the fact of much chemical difference obtaining among the tissues, not only in the proportions of their fundamental elements, but also in the addition (and proportions as well) of such others as chlorine, sulphur, phosphorus, potassa, soda, lime, magnesia, iron, etc. Vast differences vitally must be legitimately assumed for tissues that are so different chemically. But, in the fourth place, we have the authority of the Germans for asserting that the cells themselves—and they now, to the most advanced, are only protoplasm—do differ chemically, some being found to contain glycogen, some cholesterine, some protogon, and some myosin. Now such substances, let the chemical analogy be what it may, must still be allowed to introduce chemical difference. In the last place, Mr. Huxley's analysis is an analysis of dead protoplasm, and indecisive, consequently, for that which lives. Mr. Huxley betrays sensitiveness in advance to this objection; for he seeks to rise above the sensitiveness and the objection at once by styling the latter 'frivolous.' Nevertheless, the Germans say pointedly that it is unknown whether the same elements are to be referred to the cells after as before death. Kühne does not consider it proved that living muscle contains syntonin; yet Mr. Huxley tells us, in his Physiology, that 'syntonin is the chief constituent of muscle and flesh.' In general, we may say, according to Stricker, that all weight is put now on the examination of living tissue, and that the difference is fully allowed between that and dead tissue."

There is no doubt that these facts are such as will give Mr. Huxley much trouble, if he attempts to maintain the position he has assumed; and, notwithstanding his great skill in debate, we do not think he can sustain the views he has expressed upon protoplasm, or compel the scientific world to adopt them.

MANUFACTURE OF KUMIS.

Dr. Adolph Oberstein gives an account of the preparation, properties, and uses of this favorite bevarage of the Tartars. It is an alcoholic liquor made of milk, and highly prized as a remedy in lung complaints and nervous diseases.

The best material for the preparation of kumis is mare's milk, but it can also be made of cow's milk. The milk of one day is mixed wtth one sixth water and one eighth sour milk, and left in a tolerably warm spot for twenty-four hours, by which time the whole of it will have become sour. It is then thoroughly agitated by a dasher and again left for a day and the stirring repeated until the liquid has assumed a perfectly homogenous character. It is then ready for use, but ought every time, before drinking, to be thoroughly shaken up. When a supply of old liquor is on hand it can be taken in preference to sour milk for the preparation of a new quantity.

The kumis can be preserved unchanged for several months in cellars. It is an alcoholic liquor, as some of the milk sugar undergoes fermentation, and when it is distilled it yields a brandy that the Tartars prize very highly.

As the people who drink kumis are said to be exempt from consumption, its use, as a beverage, has been highly recommended, and by many physicians it is preferred to the extract of malt.

All persons who propose to drink it must bear in mind that it is highly intoxicating, and can only be trusted in moderate quantities.

RAISING OF THE STEAMSHIP "SCOTLAND" OFF SANDY HOOK.

The steamship *Scotland*, sunk off Sandy Hook some five years since by the ship *Kate Dyer*, was then probably the largest steamer ever built, except the *Great Eastern*. She was constructed of iron wholly- -masts, spars, rigging, etc., except covering for decks and joiner work. She was four hundred feet long, and forty feet beam.

Capt. T. A. Scott, formerly agent of the Neptune Submarine Company, has shown us his log-book containing details of the breaking up and removal of this vessel, which has greatly obstructed commerce, and has caused the destruction of several vessels and the loss of a number of lives.

This vessel was sunk in 22½ feet of water, embedding herself into the sand eight feet. She has now been cut off below her futtocks, and her bottom remains in the sand two feet below its surface.

A contract was made between the Government and the Neptune Submarine Co. to remove this vessel, we think, in 1868, but for some reason the work did not progress satisfac-

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*As Regards Protoplasm, in relation to Prof. Huxley's Essay on the Physical Basis of Life. By James Hutchinson Stirling, F.R.C.S., and LL.D. Edin. New Haven, Conn.: Chas. C. Chatfield & Co., 1870.

torily. Four men were killed, and other difficulties were encountered before the right way to do the work was discovered. Finally, the entire control of the job was given to Capt. Scott, March 4th, 1869, under whose able supervision the work has progressed rapidly and surely to a successful issue.

Capt. Scott himself is an expert diver, and adds to this accomplishment a full knowledge of the construction and navigation of vessels—in short, he is master of anything to be done on the water or under its surface. He has been almost daily under the water during the progress of this work, having been down an aggregate of two hundred and eighty-one hours. Thus even the minutest particulars of the work were performed under his special and immediate direction, and he himself personally blasted away and sent up over five hundred and forty-eight tuns of iron—over half of the entire weight, although six other divers were employed under him.

Eighty blasts were made, with charges varying from fifty to five hundred and seventy-five pounds of powder. In four of these blasts, pieces measuring four hundred square feet each were broken off from the sides of the vessel. The shaft, which was fourteen inches in diameter, was broken into seven pieces before it could be raised.

Finally the work was completed on the 17th July, 1870, one hundred and seventy working days in all having been expended since Capt. Scott took the job in hand, although on many of these days full work was not performed.

This vessel lay three miles out to sea from Sandy Hook, and the situation was exposed to the heavy swells and gales of wind common in that locality, rendering the work more difficult of accomplishment.

AMERICAN SUMAC.

BY PROF. H. E. COLTON.

Since the war, and in the reversal of fortune consequent thereto, many of the people of the South have turned their attention to other sources of revenue than the former staples of tobacco, corn, and cotton, and this necessity has developed new and heretofore neglected sources of revenue. For instance it is said that one county alone of the State of North Carolina shipped North last winter about $100,000 worth of quails (called partridges there), not to speak of the new industry of "*truck farming*," in which men are now making fortunes, who a few years ago would have thought it almost a disgrace to sell so apparently insignificant a thing as a strawberry.

Among these new industries, and rising rapidly into importance, are the gathering and manufacturing for market of sumac. This article is used as a dye stuff and for tanning morocco. Formerly all used was brought from Europe; now the Southern States supply a large quantity, already supplanting the low grades of the foreign article, and we hope some day ere long also to take the place of the finer grade.

The difference between

AMERICAN AND FOREIGN,

or, rather, American and Sicilian first grades, is probably due to the fact that the latter is cultivated; the former is as yet a wild product growing on those vast fields of so-called worn out land abundant through the South from their former wasteful system of farming. However, one of the largest dye manufacturers informs me that the tannin in the Southern sumac seems to be in a different form from the Sicilian, and hence the latter is still preferred by dyers, especially for fine work. Still this may be due merely to cultivation, as all know the changes that have been made from time immemorial in various grains, grasses, and fruits, by culture and care.

Tanners of morocco say that the Southern sumac, when carefully gathered, free from sticks and dirt, the leaves and leaf stem only, is equal in tannin strength to the best Sicilian; that with Sicilian at $175 per tun such sumac finely ground should bring $125 per tun. The usual price is $50 to $90, and it has sold at $110. It is like everything else; it pays to put it on the market in the best order possible.

GATHERING AND PREPARING.

In treating of the operation of gathering and preparing for market we shall first state something of the different varieties of sumac. There are six botanically different varieties of sumac in the United States; of these, three are of value, one is of little or no use, and two are poisonous. The first three resemble each other very much in leaf and size, growing from four to ten and fifteen feet high, chiefly on dry uplands, in old fields Of these three, two have hairy berries and one has a hairy down on the branch, like a deer's horn, in summer, the third has a perfectly smooth berry and branch. The leaves of all these are valuable, though we think if care were taken to keep them separate that the hairy or stag-horn sumac would be found most valuable for dyeing.

Of the other three the dwarf sumac, one or two feet high, is valueless; another grows only in swampy places, and while its juice is said to make a fine varnish, used largely in Japan, yet it is so poisonous to many persons that it is best let alone; the third is the well known poison oak.

In gathering the sumac, leaves and leaf stems should be carefully picked without any of the woody stem, then dried under cover on lattice-work shelves to give free access to air, frequently stirring or turning to prevent heating. When thoroughly dried, at the end of two or three weeks, it is sent to New York or to the nearest mill for sale. In this state it is worth from $1·25 to $1·75 per hundred lbs., but woody stems and dirt detract from its value very much. The buyer in the interior of Virginia, North Carolina, South Carolina, and Georgia can seldom afford to pay more than $1 per hundred.

At the mill it is ground very fine and screened. The mill is of the usual drug mill form: an upright wheel revolving on its edge in a circular trough, as the old-fashioned mill for grinding clay. It should be tightly inclosed; if not, a large quantity of the light, fine, powdered sumac will escape and be lost. On care and economy in this operation depend the miller's profit. After grinding, it is screened and packed in bags—162 lbs. to the bag—and thus sent to market. The bags to hold this quantity should be cut out 40x60 inches. Fourteen such bags will hold a tun. This is exactly the style and weight that Sicilian sumac is packed as sent to this country. To sell well it should be of a light green color.

The time of gathering is from July 1st to just before first frost, not later; in some parts it may commence earlier. It should be done when the flower is in full bloom, not before.

PRODUCT AND CONSUMPTION.

It is stated that the consumption of sumac in Great Britain is over 20,000 tuns per annum, and that it is yearly increasing. In this country we use 3,500 tuns of native and perhaps 3,000, or over, of foreign; probably 500 tuns of native we export. As the demand and uses for leather never grow less it is not at all probable that all which the South can produce, if properly prepared, will ever fill the needed supply; and if it should create a plethora on the market it would only cause new uses to be found for it, or engender the production of a finer article.

There is no reason why we should not export at least 5,000 tuns to Europe, and supply all our own demands. The mill machinery is said to cost $2,500 without power. With the crude article at $1·50 per hundred even, $12 to $15 per tun for grinding and bags, $10 for loss, and $10 for freight to New York, there is certainly a fair margin of profit at $90 per tun at least, which price a good article will certainly always bring in New York. Our figures of cost, also, are rather high. There is plenty of room for at least ten more mills in the now unoccupied field of North Carolina, South Carolina, and Georgia. Any good business place in the upper or middle sections of these States will do as a site.

ITS CHEMICAL PRINCIPLE AND USES.

We have stated that sumac is used for tanning and dyeing. For these purposes the user generally makes his own decoctions, and uses them when fresh and warm. It is stated that the liquor injures by standing. For tanning it is valued, as it does not discolor the leather. It is used in the same manner as a decoction of bark. Best Sicilian contains, according to Muspratt, sixteen per cent of tannin and Virginia ten per cent. We have no doubt the vastly improved mode of gathering and preparing the American sumac will now increase its quantity of tannin.

In dyeing it is used to produce a fawn and a rich yellow, a black, a peculiar shade of green, and a red. The mordants are usually tin or aluminous substances. With Brazil wood and tin solution it produces a red. With copperas and logwood a rich permanent black. With a solution of chloride of tin alone, a rich yellow, and this with Prussian blue shades of green. It is used chiefly as a base, and has the quality of giving great permanency to the colors dyed with it. The leaves of the hairy species called staghorn are considered best to dye yellow.

THE SUMAC BERRIES

are of very little value, though we think in the progress of science a use will be found for them. They are said to contain large quantities of malic acid. They are now used in small quantities by the druggists, and when ripe make a very refreshing and cooling beverage. They should by all means be kept out of the gathered leaves, as they contain a red dye, hence would injure the quality of the sumac.

A New Omnibus.

A Melbourne correspondent, in giving an account of a new sort of street conveyance, says: The scheme has attracted considerable attention here. The great principle involved is the carriage of the load below the center of gravity. The new style of conveyance has been recently patented by Mr. Dyer. Instead of the passengers being inside the vehicle, as at present, they are all outside of it. There is no close box into which twelve human beings are stuffed to inhale each other's expirations and exhalations. There is no crushing up for a seat, or putting seven in a space intended for six, and not too large for five. All inconveniences are avoided by placing the passengers back to back, instead of face to face. The new omnibus has only one hind wheel, instead of two; and this one wheel, placed in the center of the vehicle, does the work of the two now used. A light and elegant roof covers the two rows of seats, and reaches down in front far enough to shelter the passengers from rain or sun, but not far enough to obstruct their view of the opposite side of the street in which they are going. There are aprons also which draw up from the foot-board, as a protection in wet weather. The vehicle is therefore much lower than the present omnibus, being only about eight feet in hight. A passenger steps in and out at one effort from the street into his or her own separate place or division. The large wheel at the back is quite concealed, and revolves in a closed case or sheath some twelve inches in width. The seats being on two sides and the end, and being comfortably padded at the back and cushioned, the vehicle will somewhat resemble that piece of furniture known as an ottoman, with arms to it and a roof overhead. There will be an immense economy in construction, as there are no doors, no glazing, no painting of sides, no internal paneling, and only three wheels, instead of four. The draft on the horses will be much lighter, as the friction will be diminished by one fourth at least. In addition to this it is known that a wheel of large diameter is much easier to draw than one of small, so that there is no doubt but that the draft will be very largely lessened. The weight of the vehicle will not be more than two thirds of the present one, and the cost also. The vehicle, nevertheless, is not adapted for bad weather.

An Imperishable Hothouse.

From the recently published list of English patents it appears that Mr. W. P. Ayres has secured "Improvements in the Construction and Arrangement of Horticultural and other Buildings or Erections or Structures, and in the means and appliances for heating the same." These consist of roofs formed without sashes, sash-bars, putty, or paint, or any woodwork outside, and consequently no painting will at any time be required. Secondly, Mr. Ayres forms his floors, plant stages, and side or partition walls in slabs of cement concrete, strengthened in a peculiar manner so as to bear any amount of pressure that may be placed upon them, and yet admit of being perforated for the air to circulate through them, paneled to hold water for evaporation, or the pots to stand in, or perforated and paneled. These slabs, it is said, can be manufactured of any required strength, and, consequently, are suitable for fire-proof floors, partition walls, tabling, or shelving for shop, office, or warehouse fittings or for any situations where slate or marble slabs have hitherto been used, with the advantage that they can be manufactured of any size, and in the place where they are required to be used, left rough for ordinary use, or be finished plain or in colors with the face of polished marble. Thirdly, Mr. Ayres introduces a new system of heating, dispensing with plunging or fermenting material for bottom heat, and substitutes a system by which a stream of air, moist or dry, is constantly passing through the center of the earth containing the roots of the plant as well as around the sides of the pot. For glazing, Mr. Ayres uses flat glass of great strength and quality, jointed with transparent cement, or he may use glass turned up at the sides, or any other form of bent glass that he may find necessary for the purposes of his invention. The alleged advantages are, economy in first construction, portability (when desired), and when manufactured in iron, galvanized, a house so imperishable as to wear for a lifetime without further cost.

The "Physical Basis" of Fighting.

The *Gazette de France* gives the following details with regard to the supply of food for the army of the Rhine:

MEAT.—The contract for fresh meat for the army of the Rhine has been given to the syndic of the cattle merchants at the price of 15 francs 58 centimes the kilogramme—about 50,000 francs a day; the performance of this contract to begin on the 5th of August. Salt meat for the fleet is supplied by the Americans. It is the best and wholesomest, say the exporters. The principal supplies of bacon come from Brittany. Morlaix is the great storehouse for this article.

BREAD.—A considerable quantity of flour also comes from America. It is with this flour chiefly that the bread is made which is baked in Paris for the troops. It seems to be decided that in future the bread shall be baked on the spot near each camp. It has been calculated that 1,000 journeymen bakers and 250 campaigning ovens are enough to supply the wants of 400,000 men. The campaigning oven, of thin iron, can be set up in three hours and used immediately. The bread for the troops in Paris will be baked at the Invalides and other supplementary buildings. Five hundred thousand rations of food leave Paris each day for the Eastern frontier—biscuit, rice, dry vegetables, sugar, roasted coffee, brandy, wine, etc.

FORAGE.—Switzerland sends it to Nancy in the forage, taken at the root, comes to fifty francs the thousand. The Hungarian hay, delivered at the Strasburg Railway station, will cost fifty-five francs the thousand. Experience will decide as to the quality of the forage from these two markets. It is well known that there is a scarcity in France as regards this article.

What Farms they have in Illinois.

The following highly interesting statistics of the immense farms of Mr. John T. Alexander, the great farmer and stock dealer of Morgan county, have been prepared with much care, and can be relied upon as substantially correct in every respect; Number of acres of improved lands on his farms, 34,000; number of acres unimproved lands, 300. Total number of acres of land, 34,300. Aggregate value of land, $1,685,000. Value of implements in use upon his farms, $50,000. Amount paid for wages during the past year to hands employed on his farms, $76,000. Number of live stock on his farms, 90 mules, 50 cows, 150 horses, 200 oxen, and 7,000 other cattle; hogs, 700. Total value of live stock, $536,900. Product of his farm in 1869—corn, 277,500 bushels; wheat, 7,000 bushels; oats, 8,000 bushels; rye, 2 000 bushels; potatoes, 1,000 bushels; hay, 3,000 tuns; value of animals sold on his farm during the past year. $493,400. Mr. Alexander has two farms—one of nearly 8,000 acres, in Morgan county, 12 miles east of Jacksonville, upon which he resides, and the other, of 27,000 acres, in Champaign county, Ill. In addition to this large business as a farmer, Mr. Alexander buys, ships, and sells, as dealer, over 50,000 head of cattle annually.

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SOME idea may be formed of the luxurious character of New York Yachting, by reference to the cost of some of the boats belonging to the squadron. The Dauntless, owned by James G. Bennett, Jr., cost $70,000; Palmer, $50,000; Sappho, $50,000; Eva, $18,000; Vesta, $45,000; Magic, $33,000; Phantom, $42,000: Sylvie, $30,000; Rambler, $28,000; Widgeon, $38,000; Halcyon, $29,000; Fleetwing, $48,000; and the old Henrietta, $40,000.

Insects as Food.

The Rev. Dr. Nash is publishing in *Zion's Herald* a series of articles on "Insect Life." On the subject of food he says:

"Man does not refuse to use insects as food. Even we, highly civilized as we are, do not reject the lobster, the crab, or the shrimp, which, though not strictly insects, are only articulate animals, and, until recently, were classed with insects by our best entomologists. Now the Arab would be disgusted to see us feeding on lobster salad; yet he finds great delight in masticating a locust. In both the Indies epicures eat the grub of the palm weevil, which is as large as your thumb; and Sir John La Forey concurs in opinion with the ancient Greeks mentioned by Ælian, as esteeming a roasted grub very delicious food.

"Pliny tells that the Romans regarded the lossus—probably the larva of *Prionus Coriarius* found in the oak—a very great delicacy. In Jamaica, and in the Mauritius, the grub of the *Prionus Damicornus*, which is as large as a man's finger, forms an article of food. The Mexican Indians prepare a drink from a beetle (the *Cicindela curveia*), by macerating in water and spirits.

"Locust are an article of food in many parts of the world. The Ethiopians were called locust-eaters on this account by the Romans. The Arabs make them into bread, first grinding or pounding them, and then mixing them with their flour. They not unfrequently eat them boiled or stewed. The Hottentots esteem them highly, and grow fat on them. They all make their eggs into soup. Their traditions teach that they are indebted to some great conjurer for the coming of the locust. He lives a long way northward, they say, and removes a huge stone from the mouth of a deep pit, so that the locusts escape and fly to them for food. The Moors of Barbary prefer them to pigeous.

"*Cicadæ*, according to Athenus and Aristotle, were highly relished among the ancient Greeks. Pliny says the Parthians used them freely for food. Our native Indians were fond of them, as were those of New South Wales.

"The Chinese, who cannot afford to waste any edible thing, cook and eat the chrysalis of the silkworm and the larva of the hawk moth. The caterpillars of butterflies are eaten by the natives of New Holland, and also the body of the butterfly called bugong.

"Ants have their places with articles of human diet. Hottentots eat them both raw and boiled. East Indians mix them with flour and convert them into a popular pastry. In India ants are used to flavor brandy.

"In Ceylon bees are used for food. In New Caledonia the people eat a large spider (*Aranea ebuis*), esteeming it a luxury. Reaumer says he knew a young German lady who ate spiders. It is recorded that Anna Maria Schurement ate them like nuts, and declared they were not unlike that fruit in taste. Lalande, the celebrated astronomer, was equally fond of these delicacies; and Rosel knew a German who spread them on his bread like butter. Humboldt caps the climax of these edible monstrosities, assuring us that he has seen Indian children drag centipedes, eighteen inches long and more than half an inch broad, from their holes and devour them.

"While these curious facts illustrate the adage that there is no accounting for tastes, they also show that insects are useful as food for man, and that in great extremities he might be saved from destruction by placing them among his articles of diet. But I have written enough on the uses of insects—enough to show that the Great Architect of nature did not create these curious little animals in such vast numbers without a purpose. Small as they are, and contemptible as they appear, their countless numbers and varied powers to do both good and evil, constitute them one of the most important forces in the economy of nature. By merely destroying a few classes of insect-fauna, and thereby permitting the others to multiply indefinitely, the Almighty Ruler could bring about the entire destruction of the human race in a surprisingly brief period of time."

Late Atmospheric Researches.

At a meeting of the Royal Irish Academy, held June 13th, Dr. George Sigerson, F.L.S., read a paper entitled "Further Researches on the Atmosphere." He stated that the results of analysis of *ordinary atmospheres*, such as those of a town, the country, and the sea breeze, which he communicated to the Academy on a former occasion, had been fully confirmed by later investigations. The subject of the present paper was the examination of *special atmospheres*, of which the author proceeded to speak in detail. In the air of an *iron factory* he found a dust of a black color and friable in nature, which was composed of carbon, iron, and ash. The iron was present in small rough and jagged pieces, also in hollow balls averaging one two-thousandth of an inch in diameter. These iron globules were translucent. In *shirt factory* air, filaments of linen and cotton were present in great numbers, and minute eggs were also seen under the microscope: but these were, perhaps, of accidental origin. *Scotch mills*, from the nature and quality of the spongy, spiky dust which abounded in them, Dr. Sigerson branded as human slaughter houses. In the dust of printing offices, perceptible traces of antimony were detected by chemical examination. *Stable air* was shown to contain equine hair, cuticles, epithelium, moth cells, ovules, various fungi, besides a large amount of other forms of organic matter. The air of a dissecting room was also largely impregnated with organic particles, and a microscopical examination of the dust collected resolved it into portions of white and yellow fibrous tissue, fibrillæ of voluntary and involuntary muscle, fragments of epithelium, and *debris*. In *smoker's air*, numerous globules of nicotine were observed, of a pre-eminently hurtful character. Very similar to this was the air inhaled by *tea-tasters*, in which, besides particles of cellular tissue, a narcotic oil of very deadly properties abounded in the form of minute cells. In concluding his paper, Dr. Sigerson took occasion to remark that the carbon which existed in the atmospheres of large cities was of use in counteracting the injurious effects of the presence of albuminoid ammonia, lately described by Dr. Angus Smith, of Manchester, and that consequently limits should be placed to the consumption of smoke in factories, etc. The paper was illustrated by large diagrams representing the microscopical appearances of the different forms of dust spoken of above.

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Why Insects Increase.

It is an old and very true remark that the various insects that afflict the gardener and fruit grower are, year by year, becoming more numerous and destructive. The *Boston Spectator* thinks one principal cause of this result is the continued tendency of modern improvement to concetrate vegetable gardens and fruit farms in certain peculiarly favorable localities, instead of scattering them evenly and uniformly over the whole country. Hence every injurious insect that troubles the gardener and the fruit grower, has an abundant supply of such vegetation as forms a suitable nidus for its future offspring, close at hand, instead of having to look for it with much labor, over an extensive surface of country. Such insects are therefore enabled by this means to increase and multiply with greater ease and greater rapidity.

Upon precisely the same principle, if you scatter over the surface of a whole country the amount of shelled corn that is just sufficient to feed a certain gang of hogs, and compel them to seek it out and pick it up every day of the year, they will not thrive so well nor multiply so fast as if you fed out the very same amount of corn to them in a ten acre lot, day after day, for a whole year.

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State and National Fairs for 1870.

American Institute	New York	Sept. 7—Nov. 2
Arkansas	Little Rock	Oct. 11–14
California	Sacramento	Sept. 12–19
Cherokee Country	(Ga. & Ala.) Rome, Ga.	Oct. 11–14
Colorado	Denver	Sept. 27–Oct. 1
Conn. River Valley	Brattleboro, Vt.	Sept. 27–29
Cotton States	Augusta, Ga.	Oct. 25–29
Georgia	Atlanta	Oct. 19–26
Illinois	Decatur	Sept. 26—Oct. 1
Inter-State	Pittsburgh, Pa.	Sept. 12–16
Industrial Exposition	Cincinnati, O.	Opens Sept. 21
Indiana	Indianapolis	Oct. 3–8
Iowa	Keokuk	Sept. 12–16
Kansas	Fort Scott	Sept. 27–30
Kentucky	Henderson	Oct. 4–8
Maine	Augusta	Sept. 20–23
Maryland	Pamlico, near Balt.	Sept. 27–30
Michigan	Jackson	Sept. 20–23
Minnesota	Winona	Sept. 20–23
Mississippi	Jackson	Oct. 10–15
Nebraska	Brownsville	Sept. 20–23
New England	Manchester, N. H.	Sept. 6–9
New York	Utica	Sept. 27–30
New Hampshire, with	New England, which see.	
New Jersey	Waverley	Sept. 20–23
North Carolina	Raleigh	Oct. 18–21
Ohio	Springfield	Sept. 12–16
Ontario	Toronto, Canada	Oct. 3–7
Pennsylvania	Scranton	Sept. 27–30
Quebec Provinces	Montreal	Sept. 13–16
St. Louis Association	St. Louis, Mo.	Oct. 3–8
South Carolina	Columbia	Nov. 9–11
S. C. Institute	Charleston	Nov. 1–5
Texas, Western	San Antonio	Oct. 5–8
Vermont	Burlington	Sept. 13–16
Virginia	Richmond	Nov. — —
Wisconsin	Milwaukee	Sept. 27–30
Woolen Exposition	Cincinnati, O.	Sept. 21—Oct. 15
Washington Ter.	Wallawalla	Sept. 22–25

NEW BOOKS AND PUBLICATIONS.

EVERY SATURDAY

Is one of the handsomest illustrated papers ever issued. The number of September 10th contains European war pictures—the Baden Prisoners taken at Niederbronn; French Soldiers Bathing at Nancy; A Prussian Outpost; Saarbruck; and Some Recruits for the South German Army. It has, besides, fine portraits of Mademoiselle Sessi, and George W. Childs of the Philadelphia *Ledger*; a beautiful art picture, Morning in the Desert; and three admirable summer pictures—A Picnic in the Woods, by A. Hoppin; Summer Days, by W. J. Hennessy; and On the Beach at Long Branch, by C. G. Bush. Altogether, it is a first-class family illustrated weekly.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

2,061.—LAMPS.—F. T. Grimes, Liberty, Mo. July 21, 1870.

2,065.—PRODUCTION OF SULPHURIC AND HYDROCHLORIC ACIDS, OF CARBONATES OF POTASH AND SODA, AND ALSO OF CHLORINE.—H. M. Baker, New York city. July 21, 1870.

2,083.—APPARATUS FOR THE MANUFACTURE OF GAS.—E. D. McCracken, H. J. Newton, H. B. Kirkland, and Joseph R. Husson, New York city. July 26, 1870.

2,103.—PLATFORM WEIGHING MACHINE.—M. Kennedy, New York city. July 26, 1870.

2,119.—CARPET-STRETCHING AND NAILING APPARATUS.—S. Cooke, New York city. July 29, 1870.

2,148.—BUTTONS.—Joseph Hampson, Newburgh, N. Y. August 2, 1870.

2,154.—LET-OFF MECHANISM FOR LOOMS.—D. Long and J. Preston, Fairview, Pa. August 2, 1870.

2,155.—MACHINERY FOR FEEDING SHEETS OF PAPER TO PRINTING PRESSES AND OTHER MACHINES REQUIRING TO BE SIMILARLY FED.—John F. Thomas, Brooklyn, N. Y. Aug. 2, 1870.

2,166.—SEWING MACHINE.—John Paulding, New York city. August 3, 1870.

2,169.—REFINING AND AGEING LIQUORS.—S. H. Gilman, Galveston, Texas. August 3, 1870.

2,172.—APPARATUS FOR EXTINGUISHING FIRES.—C. G. Wheeler, Chicago, Ill. August 4, 1870.

2,153.—LUBRICATING PACKING FOR RAILWAY-CARRIAGE JOURNALS.—W. H. Jewell, New York city. Aug. 2, 1870.

2,159.—PRESERVING WOOD.—A. B. Tripler, New Orleans, La. August 2, 1870.

2,173.—MACHINE FOR SEWING BOOTS AND SHOES.—C. Goodyear, New York city. August 4, 1870.

2,180.—SEWING MACHINE.—Hinkley Knitting Machine Company, Bath, Me. August 4, 1870.

2,208.—BALANCE ELEVATORS.—C. B. Sawyer, Fitchburg, and J. W. Labaree and P. W. Brewster, Springfield, Mass. August 9 1870.

Business and Personal.

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

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4·00 a year. Advertisements 17c. a line

Screw Wrenches.—The Best Monkey Wrenches are made by Collins & Co. All Hardware dealers have them. Ask for Collins Wrench.

Profitable Canvassing.—"The Universal Sharpener," for all Table Cutlery and Scissors. A correctly beveled edge can be obtained by its use. See Advertisement.

A fine Double Engine, Boilers, and fixtures, complete, 2-H.P. drop and foot presses, lathes, etc., for sale by J. Dane, Jr., Newark, N. J

Blind Stile Mortising and Boring Machine, for Car or House Blinds, fixed on rolling slats. Martin Burk, Agent, Lebanon, N. H.

Upright Belt Forge Hammers, Improved Drop Presses. Send for circular. Charles Merrill & Sons, 556 Grand st., New York.

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Wanted.—Second-hand Hydraulic Press. Platen to be at at least 24-in. by 36-in.; ram 10-in. to 12-in. diameter. Apply to Joseph C. Hewitt, 17 Burling Slip, New York.

Metaline.—Paul Dunn, Owen Sound, Ontario, Canada, wants to correspond with the manufacturers of metaline.

For foot-power engine lathes address Bradner & Co., Newark, N.J.

J. R., of Leipzig, Germany.—It you have sent me the Scientific American, I pray you urgently to send me a more distinct sign of your existence, by writing personally to your—Betty.

Builders—See A. J. Bicknell's advertisement on outside page.

Peck's patent drop press. For circulars, address the sole manufacturers, Milo Peck & Co., New Haven, Ct.

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 27th, 1869. Also, Glazier's Diamonds. John Dickinson, 64 Nassau st., N. Y.

Scientific American.—Back Nos., Vols., and Sets for sale. Address Theo. Tusch, City Agent, Sci. Am., 37 Park Row, New York.

A New Waltham Watch, made especially for Railroad Men and Engineers, is fully described in Howard & Co.'s Price List of Waltham Watches. Every one interested should send for a copy, which will be mailed to any address free. Address Howard & Co., 785 Broadway, N. Y.

Peteler Portable R. R. Co., contractors, graders. See adv'ment.

For Sale—One half the interest in McGee's Patent Self-boring Faucet. Address T. Nugent, Morristown, N. J.

The best selected assortment of Patent Rights in the United States for sale by E. E. Roberts & Co., 15 Wall st., New York. See advertisement headed Patentees. Sales made on Commission.

Enterprising men wanting a genuine Patent Monopoly, please address, immediately, C. H. Hudson, 174 Washington st., New York.

"507 Mechanical Movements."—Over 18,000 copies of this book have been sold. This is by far the largest illustrated table of movements ever published. An invaluable aid to mechanics, inventors, etc. Price $1. By mail, $1·12. Address Theo. Tusch, 37 Park Row, New York.

Best Boiler-tube cleaner—A. H. & M. Morse, Franklin, Mass.

For Sale or to Lease—A never-failing water-power at Ellenville, N. Y., ½ mile from depot of the Ellenville Branch N. Y. and O. Midland R. R., and only 80 miles from New York city, by rail. For full particulars address Blackwell, Shultis, Gross & Co., Kingston, N. Y.

Pictures for the Library.—Prang's latest publications: "Wild Flowers," "Water Lilies," "Chas. Dickens," Sold in all Art Stores.

Japanese Paper Ware—Spitoons, wash basins, pails, milk pans, etc. Perfectly water-proof, and will not break or rust. Send for circulars. Jennings Brothers, 352 Pearl st., New York.

"Your $50 Foot Lathes are worth $75." Good news for all. At your door. Catalogues Free. N. H. Baldwin, Laconia, N. H.

The Best Hand Shears and Punches for metal work, as well as the latest improved lathes, and other machinists tools, from entirely new patterns, are manufactured by L. W. Pond, Worcester, Mass. Office, 98 Liberty st., New York.

Wm. Roberts & Co., Designers and Engravers on Wood, 36 Beekman st., New York, would respectfully announce that they are now prepared to receive orders from Manufacturers, and others, for engraving of machinery, views of stores, factories, trade marks, etc., etc.

One 60-Horse Locomotive Boiler, used 5 mos., $1,200. Machinery from two 500-tun propellers, and two Martin boilers very low Wm. D. Andrews & Bro., 414 Water st., New York.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Keuffel & Esser, 116 Fulton st., N.Y., the best place to get 1st-class Drawing Materials, Swiss Instruments, and Rubber Triangles and Curves.

For tinmans' tools, presses, etc., apply to Mays & Bliss, Plymouth, st., near Adams st., Brooklyn, N. Y

Glynn's Anti-Incrustator for Steam Boiler—The only reliable preventative. No foaming, and does not attack metals of boiler. Liberal terms to Agents. C. D. Fredricks, 587 Broadway, New York.

Cold Rolled—Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

For mining, wrecking, pumping, drainage, and irrigating machinery, see advertisement of Andrews' Patents in another column.

It saves its Cost every sixty days—Mitchell's Combination Cooking Stove. Send for circular. R. B. Mitchell, Chicago, Ill.

To ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's manufacturing news of the United States Terms $4·00 a year.

Inventions Examined at the Patent Office.—Inventors can have a careful search made at the Patent Office into the novelty of their inventions, and receive a report in writing as to the probable success of the application. Send sketch and description by mail, inclosing fee of $5. Address MUNN & CO. 37 Park Row New York

Caveats are desirable if an inventor is not fully prepared to apply for a patent. A Caveat affords protection for one year against the issue of a patent to another for the same invention. Patent Office fee on filing a Caveat, $10. Agency charge for preparing and filing the documents from $10 to $12 Address MUNN & CO., 37 Park Row, New York.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal.

All reference to back numbers should be by volume and page.

R. D. V., of Ala., has a horizontal engine, placed on a second floor, which does not nearly do the work it was indicated to perform when first set in its present position. It has run for two years much lighter work than its real capacity, and upon the addition of machinery of a somewhat taxing character, on account of its intermittent action, the engine fails to develop the power required, and what it was supposed to be able to perform. Our correspondent is not an expert, and wishes to know the probable reason of the failure. We hazard the opinion that the placing of additional machinery in the building has caused settling, and has thrown the parts of his engine out of line, causing great friction, and thus diminishing the power of the engine to do useful work. If the valve gear was properly adjusted, and the valve properly set at first, and allowed to remain so, the cause we have named is the most probable There are other causes which may produce such a result, but they can only be accurately determined by indicating the engine.

G. B., of Mass.—We have read your note, and stand corrected. As you point out there is an error in the reply to J. H. S., published on page 138, current volume. It is not necessary that in weighing a load on a wagon by first weighing the fore wheels and then the hind wheels, that these wheels should bear equal parts of the weight. The only condition necessary is that the wheels should stand exactly level at each weighing, A pretty close approximation could thus be made to the weight, but complete accuracy cannot be relied upon in this way. There is an element of error in the friction of the axles in the hubs, as one end depresses the scale, and it is evident that a perfect level is extremely difficult, if not impossible, to obtain where one pair of wheels rests on an immovable base, and the other pair upon the platform of the scale.

U. B., of Fla.—From your description of the boiler in your charge we judge it to be dangerous, and believe that at all hazards you ought to make public the facts to citizens of the town in which you live. The reckless exposure of life by parsimonious users of steam boilers has become far too common in this country. You will not in the end lose by the fearless performance of what you deem to be your duty. This advice is based on the supposition that yon have "set down naught in malice." The fact that you still retain charge of the boiler after having become afraid of it somewhat detracts from the weight of your assertions.

B. F. S., of Pa.—The power developed by a water wheel is entirely independent of the gearing and machinery. If you wish to ask whether the power of the wheel will be more economically applied through a master wheel of equal diameter to the wheel or one of three fourths its diameter, we answer that there would not be much difference. The little there would be would favor the larger wheel; as the higher the velocity of the teeth in a gear the less is its friction proportionately in transmitting a given amount of power if all things are properly constructed and adjusted.

A. G. and J. M., of N. J.—The velocity of a steamer relatively to the current of water in which she floats, with a given number of revolutions of her paddle wheels per minute, is the same whether going with or against a current. The velocity relatively to a fixed point on shore will differ in going with the current, from that in going against the current, by an increase of twice the velocity of the current, the same number of revolutions per minute being made in each case.

J. M. K., of N. H.—All kinds of glass.ware may be cheaply colored during its manufacture.

A. M. W., of ——Your query is answered in reply to H. A. W., of N. C.

D. D., of Mass.—The hydraulic device you describe will not work,

Recent American and Foreign Patents.

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

Machine for Bending and Shaping Forks.—I. G. Batcheller, Wallingford, Vt.—This invention relates to improvements in machinery for bending and shaping the tines of hay, manure, spading, and other forks after they have been rolled, hammered, or otherwise reduced to the proper sizes and lengths; and it consists in a very ingeniously contrived pair of bending and shaping blocks, in one of which the blank is placed and held while the outside tines are bent around the block for making them parallel with the intermediate ones, by bending slides moving along the sides of the block. The other block, which is the counterpart of the first, moves over the latter after the above bending of the side tines has been effected, and then the first mentioned block upwards against the other, by which the blank is clamped between them for imparting the requisite curve from heel to point to give the proper set to the tines. This machine is very simple in construction and has but few movements, which may be quickly performed. It therefore seems calculated to prove a very important advance in the class of machinery to which it belongs. Several of these machines are to be employed by the Batcheller Manufacturing Company, Wallingford, Vt., of which the inventor is a prominent officer.

Wood Turning Lathe.—Frederick Baldwin, Janesville, Wis.—This invention relates to improvements in automatic lathes for turning spirally beaded work, and consists in an attachment to the improved lathe, on which patents were granted 24th day of August, 1858, No. 21,240, and the 18th day of June, 1867, No. 65,864, for increasing or diminishing the feed when cutting spirals on tapered sticks, and to vary the pitch of the spirals according to the size, the same being so arranged that the machine may be readily shifted to turn tapered sticks or sticks with uniform diameter throughout, and when tapered work is produced, the alternate sticks following each other through the mandrel in succession will be worked from the large to the small end, and *vice versa*.

Paddle Wheel.—R. H. Connelly, Philadelphia, Pa.—This invention relates to improvements in feathering paddle wheels for steamboats, and consists in an improved arrangement of wheel or wheel rim mounted eccentrically to the paddle wheel and having the cranked axles of the buckets connected to it for causing the feathering of the buckets.

Press.—Marshall Wallace, Little Rock, Ark.—This invention relates to improvements in presses for hay and cotton, and consists in an improved arrangement with a follower working upward and having ratched teeth on the stem, of lifting levers with sliding pawls, also sliding holding pawls and eccentric lever for working the levers acting on the follower stem. The invention also comprises an arrangement with the follower of counterbalanced weights to assist in raising it and to let it down easily.

Shade Holder and Shade.—T. B. Peacock, Dresden, Ohio.—This invention has for its object to furnish an improved shade holder and shade which may be applied to lamps, gas burners, candles, etc., and which shall be so constructed that the shade may be easily adjusted at any desired hight or at any desired inclination, and which shall at the same time be simple in construction and convenient in use.

Cotton Press.—W. W. Knowles, Bastrop, Texas.—This invention has for its object to improve the construction of cotton or baling presses so as to enable the press to be worked faster than is possible with presses constructed in the ordinary manner, the screw being run in both directions by the continuous forward movement of the driving shaft, adapting the press to be worked by steam, water, or other power.

Sugar Cane Scraper.—Alcide Landry, Parish of East Baton Rouge, La.—This invention has for its object to furnish a simple, convenient, and effective machine for scraping and cultivating sugar cane.

Corn Planter.—Lewis West, Georgetown, Ky.—This invention has for its object to furnish an improved corn planter, simple in construction and effective in operation, doing its work accurately and well.

Removing Paraffine Deposits from Oil Wells and the Crevices of the Oil Rock.—James Dickey, Venango, Pa.—This invention relates to a new and improved means of removing the paraffine and other combustible deposits from the oil wells and the crevices of the oil-bearing rock leading thereto, and it consists in burning out the paraffine by means of oxygen or other combustible gas introduced through the well or otherwise in pipes, or by other means, and ignited in the presence of the paraffine, the said gas being introduced by pumps or otherwise; also in effecting the removal, but in a more limited degree, by exploding the oxygen gas, together with the gas produced in the well.

Water Meter.—Andrew Morse, Skowhegan, Me.—This invention relates to improvements in water meters, and consists in a combination with a weighted valve to be raised by the water to be measured, and the registering apparatus of a graduated variable cam block for operating the pawl of the registering apparatus, a water wheel for turning the said cam to operate the pawl, and an escapement mechanism for regulating the motion of the water wheel, all so arranged that the registering apparatus will be moved more or less according to the amount of water passing through the said valve.

Torpedoes for Oil Wells.—Jas. Dickey, Venango, Pa.—This invention relates to improvements in torpedoes for oil wells, and consists in the application to the exteriors of the shells of spring guides, for centering them in the wells after passing below the iron casing, or in open wells. The invention also consists in an improved arrangement of charging and stopping nozzles for charging the torpedoes, such as were patented September 14, 1869, with oxygen gas. The invention also consists in an improved mode of firing the torpedo by means of a bomb or secondary torpedo dropped upon the primary one, and provided with a discharging spindle in the lower end, arranged to act upon another spindle in the top of the first for exploding a cartridge or other detonating substance on the top of the torpedo and another in the bottom of the bomb.

Water Wheel.—V. M. Baker, Preston, Minn.—This invention relates to improvements in turbine water wheels, and consists in certain improvements in the construction and arrangement of case, gates, buckets, and the means for actuating the gates.

Canal Boat.—Lewis and Charles Howard, Watkins, N. Y.—This invention consists of a bar placed at the stern of the boat across the rear end of the chamber that contains the propeller, said bar serving as a brace between the sides of the chamber; also as a guide for the vertical sliding post, in which is supported the rear end of the propeller shaft, and also as a support for the lower end of the rudder.

Cutter Bars for Mowers and Reapers.—Henry W. Mason, Hagerstown, Md.—This invention has for its object to attach teeth to cutter-bars in mowing and reaping machines in such manner that the teeth may be kept in place in the bar without the use of springs, screws, or any device, except a groove and tenon or the equivalent thereof, and yet may be separately removed from the bar and replaced in the same without difficulty.

Combined Corn Planter and Seeder.—William E. Fricke, Mexico, Mo.—This invention has for its object to furnish a simple convenient and effective machine, which shall be so constructed that it may be conveniently adjusted for planting or seeding, and which will do its work well and accurately in either capacity.

Combined Call Bell and Vessel.—Nathan Lawrence, Taunton, Mass.—This invention relates to a vessel that may be used as a slop-bowl or sugar-bowl, from the bottom of which a tube projects upward within the vessel; a stem being placed within said tube, extending above its top, passing through the bottom of the vessel and furnished with a finger-piece at its upper end outside the tube; the sounder of a call bell being attached to the bottom of the vessel, and while its tongue is hung between lugs that extend downward from the top of the sounder, in a position where it may be forced against the inside of the sounder by thrusting the said stem downward.

Bedstead.—Francis Layaux, Monroe, La.—This invention consists in a tester, to which two rods are attached beneath, one at each side, on which rods are placed sliding rings, to which the upper edges of the net are fastened; there being also a cross-bar that slides on the two side rods, on which bar are also placed some of the net rings, the whole arrangement being such that when the cross-bar is moved on the side rods to one end of the tester, the net is folded together, and when the cross-bar is moved to the opposite end of the tester, the net is expanded.

Press for Printing Oilcloths, Tablecloths, etc.—Joseph Kraft Newark, N. J.—This invention relates to a new machine for printing designs of various colors upon the surfaces of oilcloths, glazed cloths, or other fabrics, the apparatus being even applicable to the printing of cotton or silk goods. The invention consists in constructing each of the printing cylinders with projecting types for making but half the design, the other reversed half being made by reversing the position and motion of the fabric to be printed. The invention consists, also, in the use of a swiveled frame for holding the fabric to be printed, the said frame being reversible, for the purpose of permitting the fabric to be brought to opposite position and motion, while the reverse half of the design is being printed.

Flying Ship.—Edward Oakes, Richmond, Ind.—This invention relates to improvements in vessels or ships for navigating or sailing through the air, while suspended in it by balloons. The invention consists in the combination with one or more semi-cylindrical balloons, preferably with pointed ends and flat bottoms, of a sail of peculiar construction, a pair of adjustable guiding wheels or propellers, and one or more lifting and depressing wheels, under improved arrangement calculated to enable the operator to so guide and control the ship as to cause it to ascend and descend when required and to move through the air, in ascending or descending planes, in any required direction.

Automatic Trap for Lowering Ice, Boxes, etc.—Charles Egnor, Catskill, N. Y.—This invention relates to a new apparatus for conveying goods to the holds of vessels, or to lower stores of buildings, and is more particularly intended for delivering blocks of ice from icehouses to barges. The invention consists in the combination of a hinged trap with a swinging end piece, the latter arresting the ice, while the trap is being swung down. When the trap is near the lower position, the end piece is arrested by a a string or cord, and allows the ice to pass under it into the hold of the barge.

Wood-bending Machine.—James K. B. Solomon, Rigglesville, Pa.—This invention relates to a new machine for bending the fellies of wagon wheels as well as sleigh runners, plow handles, and other suitable articles of wood. The invention consists chiefly in the use of a pair of chain drums or rollers, which serve to wind up a pair of chains, whereby the ends of the wooden bar or article to be bent can be drawn against the edges of a bending block.

Door Strip.—John W. Kramer, Bloomsburg, Pa.—This invention relates to improvements in door, weather, or carpet strips, and consists in a flat metal or other strip under the door, hinged at the ends at one edge, and having a link or yoke under it, pivoted to the sill at one end, and connected at the other to a rod connected with a spring in the jamb, which is acted on by the door, when closing, to throw the free edge of the strip up to the door.

Car Coupling.—James H. Froman, Plattsburg, Mo.—This invention relates to a new car coupling, which is so arranged that it will be entirely reliable, while the cars are properly on the track, but will cause an automatic uncoupling when the cars run off the track, or down over the end of a bridge.

Mitering Machine.—Daniel B. Ware, Athens, Mich.—This invention relates to a new mitering machine, which is so constructed as to be readily adjustable, to cut all kinds of miters at any desired pitch.

Stave Jointer.—James F. Sayer, Maycomb, N. Y.—The object of this invention is to make an adjustable machine for holding and jointing all sizes and kinds of staves, such as are used for barrels, as well as those without a bilge, which are used for straight-sided cylindrical or conical tubes.

Spades and Shovels.—Jacob Caylor, Half Way, Ind.—This invention relates to a new manner of constructing the blade of a spade, and, also, to a novel method of securing spades and shovels to the handles, and to a novel construction of the handles.

Cattle Stancheon.—John D. Scott, Alviso, Cal.—The object of this invention is to provide a simple and efficient device for operating and fastening the pivoted stanchions by which horned cattle are confined to their stalls.

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING August 30, 1870.

Reported Officially for the Scientific American

SCHEDULE OF PATENT OFFICE FEES

On each caveat	$10
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A sketch from the model or drawing, relating to such portion of a machine as the Claim covers, from .... **$1** *upward, but usually at the price above-named.*

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106,760.—Truss Bridge.—J. S. Adams, Elgin, Ill.
106,761.—Neck Tie.—Moritz Altman, Baltimore, Md.
106,762.—Lubricating Box.—Charles Andrews, Providence R. I.
106,763.—Gate.—Thomas Andrews, Warren, Wis.
106,764.—Street Lamp.—Theodore P. Austin, New York city.
106,765.—Combined Harrow and Roller.—Timothy Bailey Wyoming, Ill.
106,766.—Water Wheel.—Vincent M. Baker, Preston Minn.
106,767.—Wood-turning Lathe.—Frederick Baldwin, Janesville, Wis.
106,768.—Shaft Coupling.—M. S. Bassett (assignor to himself and L. H. Burt), West Haven, Conn.
106,769.—Machine for Bending Forks.—I. G. Batcheller, Wallingford, Vt.
106,770.—Curtain-cord Tightener.—J. E. Baum, Philadelphia, Pa.
106,771.—Fire-proof Railway Cars.—G. C. Bestor, Peoria, Ill.
106,772.—Fireplace Grate.—Frank S. Bissell, Pittsburgh Pa.
106,773.—Toothpick.—W. E. Blake, New York city.
106,774.—Shuttle-stopping Device.—Theodore Bosshard Columbus, Ohio.
106,775.—Machine for Upsetting Tires.—Wm. Bowden (assignor to himself and A. C. Calkins), Hamburg, N. Y.
106,776.—Wardrobe Bedstead.—Sanford S. Burr, Boston, Mass.
106,777.—Steam Engine.—Henry L. Butler and Thomas A. Christie, Pittsburgh, Pa.; said Christie assigns his right to said Butler.
106,778.—Paper File.—John Cash and Joseph Cash, Jr., Coventry, England.
106,779.—Spade and Shovel.—Jacob Caylor, Half Way, Ind.
106,780.—Velocipede.—J. C. Clime, Philadelphia, Pa.
106,781.—Driving Mechanism for Sewing Machines.—John Cochrane, Jr., Malden, Mass.
106,782.—Circulating Water Heater for Steam Fire Engines.—H. V. Coleman, Chicago, Ill.
106,783.—Scaffolding.—James V. Cook and E. J. Crossman, Auburn, N. Y.
106,784.—Manufacture of Paint and Varnish.—G. F. Cornelius, Westminster, Great Britain.
106,785.—Book Marker.—Edmund Cottle, Randolph, Mass.
106,786.—Railroad-car Duster and Ventilator.—J. P. Curry, New York city.
106,787.—Water Wheel.—Dwight Cushman, Hartford, Conn.
106,788.—Gathering Device for Sewing Machines.—Job A. Davis, Watertown, N. Y. Antedated August 17, 1870.
106,789.—Creasing Attachment for Sewing Machines.—J. A. Davis, Watertown, N. Y. Antedated Aug. 26, 1870.
106,790.—Musical Rocking Chair.—Clayton Denn, Frankford, Philadelphia, Pa.
106,791.—Adjustment for Pump Rods.—Byron Densmore, New York city. Antedated August 24, 1870.
106,792.—Water Meter.—Byron Densmore, New York city. Antedated August 24, 1870.
106,793.—Removing Deposits from Oil Wells.—Jas. Dickey, Venango City, Pa.
106,794.—Torpedo for Oil Wells.—Jas. Dickey, Venango City, Pa.
106,795.—Pencil Sharpener.—M. W. Dillingham, Amsterdam, N. Y.
106,796.—Tension Device for Sewing Machines.—G. L. Dulaney, Mechanicsburg, Pa.
106,797.—Roller Temple for Looms.—W. W. Dutcher (assignor to the Dutcher Temple Co.), Hopedale, Mass.
106,798.—Trap for Lowering Ice.—Chas. Egnor, Catskill, N. Y.
106,799.—Gang Plow.—Abram Ellison, Marysville, Cal.
106,800.—Marine Engine.—John Ericsson, New York city.
106,801.—Maximum and Minimum Water Gage.—George Jordan Firmin, No. 19 Lorn Road, North Brixton, England. Patented in England April 25, 1870.
106,802.—Portable Sprinkler.—W. L. Fish, Springfield, Mass. Antedated Aug. 18, 1870.
106,803.—Machine for Forming Sheet-metal Moldings.—H. G. Fiske, San Francisco, Cal.
106,804.—Rotary Steam Engine or Pump.—George Stores Foliansbee (assignor to himself and John Rosencrantz), Philadelphia, Pa.
106,805.—Folding Seat.—Charles A. French, Lowell, Mass.
106,806.—Combined Planter and Seeder.—W. E. Fricke, Mexico, o.
106,807.—Car Coupling.—James H. Froman, Plattsburg, Mo.
106,808.—Plane Guide.—Michael Garland, West Eau Claire, Wis.
106,809.—Loom.—L. M. Gilbert, Cow Run. Ohio.
106,810.—Tobacco Ridger.—Ozias W. Goslee, Glastenbury, Conn.
106,811.—Milk Cooler.—Warren H. Gould, Manchester, N. H.
106,812.—Fire Escape.—J. A. Griswold (assignor to himself and P. E. Merrihew), Chicago, Ill.
106,813.—Treadle Motion.—Charles M. Guess, New Orleans, La.
106,814.—Boot and Shoe Heel.—H. F. Harris and G. P. Pinney, Chicago, Ill.
106,815.—Escapement for Watches, etc.—Wm. Hart, Kirksville, Mo.

106,816.—Measuring Faucet.—Francis C. Heiser, Brooklyn, N. Y.

106,817.—Carriage.—J. R. Hiller (assignor to himself and Clark Elliott), Woodland, Cal.

106,818.—Lime Kiln.—David Hills, Richville, N. Y.

106,819.—Covering Metal Articles with India Rubber.—Constantine Hingher, New Brunswick, N. J.

106,820.—Low-water Indicator.—G. M. Hopkins and J. A. Straight, Albion, N. Y. Antedated Aug. 26, 1870.

106,821.—Low-water and High-pressure Indicator.—George M. Hopkins and John A. Straight, Albion, N. Y. Antedated Aug. 13, 1870.

106,822.—Broom-crotch Supporter.—Hiram Hopkins, Wellfleet, Mass.

106,823.—Coloring Gun Barrels.—James Spooner Howard, Mansfield, assignor to himself. T. E. Grover, same place, E. Adams, Jr., and N. Carpenter, Attleborough, Mass. Antedated Aug. 19, 1870.

106,824.—Propeller.—Lewis Howard and Chas. Howard, Watkins, N. Y.

106,825.—Roofing.—Seymour Hughes, Hudson City, N. J.

106,826.—Portable Fence.—Eli Hunt, Hartford, Ind.

106,827.—Barrel.—G. M. Huntly, Grand Rapids, Mich.

106,828.—Fluting and Sadiron.—Charles Hyatt, Buffalo, N. Y.

106,829.—Wire Cutter.—Joseph Johnson, Marshalltown, Iowa.

106,830.—Lock for the Meeting Rail of Sashes.—F. W. Judd and G. H. Hubbard, New Haven, Conn.

106,831.—Fanning Mill.—Daniel Kane, Tivioli, Iowa.

106,832.—Pavement.—John Stafford Kelley, New York city.

106,833.—Cotton Press.—William W. Knowles, Bastrop, Texas.

106,834.—Machinery for Printing Oilcloth, etc.—Joseph Kraft, Newark, N. J.

106,835.—Door Strip.—J. W. Kramer, Bloomsburg, Pa.

106,836.—Churn.—Hermann Kuhlmann, Cincinnati, Ohio.

106,837.—Combined Plow and Cultivator.—J. M. Landes, Souders, Pa.

106,838.—Manufacture of Plowshares.—John Lane (assignor to himself, C. H. Hapgood, W. B. Young, and G. H. Laughton), Chicago, Ill.

106,839.—Sugar-cane Scraper.—Alcide Landry, East Baton Rouge, La.

106,840.—Call-bell and Vessel.—Nathan Lawrence, Taunton, Mass.

106,841.—Elevator.—Alfred Lawton, Philadelphia, Pa.

106,842.—Bedstead Tester.—Francis Layaux, Monroe, La.

106,843.—Clock Escapement.—B. B. Lewis, Bristol, Conn., assignor to himself and Welch, Spring & Co.

106,844.—Reel for Dyeing and Finishing Silk and Velvet Woven Fabrics.—Edward Mafat, New York city. Antedated August 25, 1860.

106,845.—Construction of Brushes.—John Marchbank, Lansingburg, N. Y.

106,846.—Medical Compound.—Ann Augusta Marsh, Frankfort, Mich.

106,847.—Safety Car Brake.—Anthony S. Martin, Washington, D. C.

106,848.—Churn.—G. H. McGlothlen, Chariton, Iowa.

106,849.—Combined Lock Nut and Splice Bar.—Robert L. McGowan, New Brighton, assignor to himself, Charles A. Woods, Pittsburgh, Pa., John Fletcher, Ravenna, Ohio, and Thomas Johnston, Allegheny, Pa.

106,850.—Molding Flask.—John McLaughlin (assignor to himself and Jacob Appie), Philadelphia, Pa.

106,851.—Treatment of Guano and the Manufacture of Fertilizers.—Campbell Morfit, New York city.

106,852.—Water Meter.—Andrew Morse, Skowhegan, Me.

106,853.—Washing Machine.—Russell S. Morse, Chelsea, Mass.

106,854.—Iron Building.—Thomas W. H. Moseley, Boston, Mass.

106,855.—Bridge.—T. W. H. Moseley, Boston, Mass.

106,856.—Hood for Planing Machine.—B. D. Mott, Green Island, assignor to himself and Harcourt Mott, Troy, N. Y.

106,857.—Lubricator.—Charles Nelson, Brooklyn, E. D., N. Y.

106,858.—Animal Trap.—Abner Newton, Darby Creek, Ohio.

106,859.—Cotton-seed Planter.—Henry Nicholls, Fairfield, Ky.

106,860.—Oscillating Steam Engine.—August Nittinger, Jr., Philadelphia, Pa.

106,861.—Combination Side Door.—C. H. Noyes, Brooklyn, N. Y.

106,862.—Aerial Car.—Edward Oakes, Richmond, Ind. Antedated August 25, 1870.

106,863.—Apparatus for Producing Gas from Coal.—Timothy O'Meara, Brooklyn, N. Y., assignor to himself, J. F. Preston, R. M. Fryer, Dwight Marcy, and A. R. Fryer, assignors to United States Gas Co., Rockville, Conn.

106,864.—Cultivator.—B. F. Osborn (assignor to T. H. Jones & Co.), Nashville, Tenn.

106,865.—Earth Scraper.—Silas S. Owen, Stewartsville, Mo.

106,866.—Lamp Shade Holder.—T. B. Peacock, Dresden, Ohio.

106,867.—Operating Valve.—A. L. Pennock, Upper Darby, Pa.

106,868.—Carpenters' Plane.—Russell Phillips, Boston, Mass.

106,869.—Scale for Showing Weight and Price.—W. H. Phinney, Pawtucket, R. I.

106,870.—Washing Machine.—John Prehn, New York city.

106,871.—Cleansing Wool.—Emil F. Richter, Berlin, Prussia.

106,872.—Press for Stencil Printing.—H. W. Rudolph, Louisville, Ky.

106,873.—Treadle Motion.—George B. Safford, Burlington, Vt.

106,874.—Stave Jointer.—J. F. Sayer, Macomb, N. Y.

106,875.—Compound or "Rough Stuff" to be Applied to Carriage Bodies, etc.—Edward Scharnikow, Margarettville, N. Y. Antedated August 19, 1870.

106,876.—Cattle Stanchion.—John D. Scott, Alviso, Cal.

106,877.—Composition for Blacking Stoves, etc.—T. C. Scottron and Sidney Plummer, Springfield, Mass.

106,878.—Liquid Meter.—H. C. Sergeant, Newark, N. J., assignor to William Tobin, New York city.

106,879.—Meat Chopper.—A. R. Silver (assignor to himself and John Deming), Salem, Ohio.

106,880.—Machine for Bending Wood.—J. K. B. Solomon, Rigglesville, Pa.

106,881.—Adding Machine.—C. E. Spear, Gardiner, Me., assignor to Eugene Humphrey, Chelsea, Mass.

106,882.—Process for Manufacturing Plug Tobacco.—Lewis W. Spencer (assignor to Peter Lorillard, New York city).

106,883.—Plug Tobacco Machine.—L. W. Spencer (assignor to Peter Lorillard), New York city.

106,884.—Valve for Pneumatic Draw in Organ.—Adam Stein, Westfield, Mass.

106,885.—Combined Stocking Supporter and Skeleton Waist.—Augusta M. Stiger, Brooklyn, N. Y.

106,886.—Cornish Engine.—John Storer, Peekskill, N. Y. Antedated August 18, 1870.

106,887.—Stock Car.—Zadok Street, Salem, Ohio.

106,888.—Stock Car.—Zadok Street, Salem, Ohio.

106,889.—Combined Furnace and Teakettle.—C. L. Taylor and G. C. Setchell, Greenville, Conn.

106,890.—Curtain Fixture.—Charles M. Thielcke, Chicago, Ill.

106,891.—Harvester.—John S. Truxel, Greensburg, Pa.

106,892.—Compressed-Air Forge Hammer.—Charles Vogel, New York city.

106,893.—Hay and Cotton Press.—Marshall Wallace, Little Rock, Arkansas.

106,894.—Miter Machine.—Daniel B. Ware, Athens, Mich.

106,895.—Extensible Gas Pendants.—George Warner, Des Moines, Iowa. Antedated August 24, 1870.

106,896.—Seeding Plow and Planter.—Jas. B. Watt and John C. Watt, Greene county, Ohio.

106,897.—Knife and Fork Cleaner.—Herrman Wegner and Friedrich Wegner, West Troy, N. Y.

106,898.—Corn Planter.—Lewis West, Georgetown, Ky.

106,899.—Steam Engine and Pump.—George Westinghouse, Jr., Pittsburgh, Pa.

106,900.—Clamp.—Levi Wharton, Salem, Ohio.

106,901.—Heel-rounding Machine.—J. C. White, Auburn, N. Y.

106,902.—Brush.—John L. Whiting, Boston, Mass.

106,903.—Harvester.—D. D. Whitker, New York city, assignor to J. McGhee, for one half of the invention. Antedated August 18, 1870.

106,904.—Pump.—Martin Wilcox, Sacramento, Cal.

106,905.—Medical Compound.—Wm. M. Wilson and Dallas S. Denton, Polk county, Mo.

106,906.—Folding Table.—Albert Windeck, Peoria, Ill.

106,907.—Apparatus for Treating Club Feet.—Geo. B. Wood, Chicago, Ill.

106,908.—Harrow.—Stephen Woodard and Albert Woodard, Saratoga, Ind.

106,909.—Blacking Box and Brush.—C. E. Yager, Hudson, N. Y.

106,910.—Wood Pavement.—Henry J. Alvord (assignor to himself and C. E. Bishop), Washington, D. C.

106,911.—Cement.—Daniel Arndt, Cleveland, Ohio. Antedated August 25, 1870.

106,912.—Machine for Packing Flour.—B. F. Bashor, Carter's Depot, Tenn.

106,913.—Track Lifter.—Joseph M. Batchelor, Foxcroft, Me.

106,914.—Hoisting Apparatus.—M. K. Carpenter, Cincinnati, Ohio.

106,915.—Treating Acid Tar from Coal.—Gervais Chevrier, Paris, France.

106,916.—Hay Loader.—David Clagett, Hagerstown, Md.

106,917.—Automatic Gate.—James B. Cottom, Dayton, Ohio.

106,918.—Fertilizer.—B. R. Croasdale, Philadelphia, Pa. Antedated August 19, 1870.

106,919.—Hollow Auger.—Austin F. Cushman, Hartford, Conn.

106,920.—Fastening for Garments.—Joseph E. Dallon, Brooklyn, N. Y.

106,921.—Case Stand.—A. De Puy (assignor to R. Hoe & Co.), New York city.

106,922.—Dovetailing Machine.—Jos. Dill, Grand Rapids, Mich.

106,923.—Liquid Slating for Forming Black Boards, etc.—W. W. Dudley, Centreville, Ind.

106,924.—Apparatus for the Manufacture of Elastic Fabrics.—C. A. Ensign, Naugatuck, Conn.

106,925.—Combined Spool and Needle Threader.—Geo. P. Farmer, Philadelphia, Pa.

106,926.—Stump Extractor.—Enoch Farnsworth, Sabbath Rest, Pa.

106,927.—Apparatus for Saturating Fellies with Oil.—J. R. Faus, Espy, Pa.

106,928.—Sash Fastener.—Henry Fickel (assignor to himself and D. G. Brown), Dayton, Ohio.

106,929.—Churn.—Moses Gascon, Malvern, Ohio.

106,930.—Machine for Tonguing and Grooving.—Peter Geiser and L. P. Thompson, Waynesborough, Pa.; said Thompson assigns to said Geiser.

106,931.—Machine for Rounding Fellies for Wheels.—Henry A. Gore, Goshen, Ind.

106,932.—Head Block.—Henry H. Grindley, Auburn, N. Y.

106,933.—Tackle Block.—Joseph F. Harcourt, Cincinnati, O.

106,934.—Corset Spring.—T. A. Hares (assignor to himself and C. Van Ness), New York city.

106,935.—Churn Dasher.—John Harris, Palestine, Ill.

106,936.—Car Coupling.—Charles M. Hoag, Nassau, N. Y.

106,937.—Sash and Blind Machine.—R. D. Hobart (assignor to himself and J. V. Simmons), Binghampton, N. Y.

106,938.—Die for Forming Eyelets.—Esek Tallman and N. G. Hoxsie, Providence, R.I., administrators of David K. Hoxsie, deceased, assignors to Waterbury Brass Company and American Flask and Cap Company, Waterbury, Conn.

106,939.—Machine for Cutting out the Ends of Eyelets.—Esek Tallman and N. G. Hoxsie, Providence, R. I., administrators of D. K. Hoxsie, deceased, assignors to Waterbury Brass Company and American Flask and Cap Company, Waterbury, Conn.

106,940.—Railroad-Car Ventilator.—W. H. Hunt, Bolton, Conn.

106,941.—Bureau.—Cheney Kilburn, Philadelphia, Pa.

106,942.—Fastening for Policemen's Badges.—Thomas Kirkpatrick, New York city.

106,943.—Sewing Machine.—J. L. Lake, Brooklyn, N. Y.

106,944.—Vapor Bath Apparatus.—U. L. Leete, Owego, N.Y.

106,945.—Machine for Cutting and Binding Grain.—S. D. Locke, Janesville, Wis.

106,946.—Cooking Stove.—W. B. Mackenzie, Cincinnati, Ohio.

106,947.—Shifting Carriage Top.—O. E. Mallory, Batavia, N. Y.

106,948.—Harvester Cutter.—H. W. Mason, Hagarstown, Md.

106,949.—Revolving Grain Screen.—Francis Mills, Mount Vernon, Ind.

106,950.—Feeder for Grain Drill.—M. L. Nickels (assignor to himself and Thomas Nickels), Dunlapsville, Ind.

106,951.—Machine for Making Wire Bells.—R. W. Norton, New Haven, Conn.

106,952.—Package for Tea and Coffee.—Henry Odenkirchen, New Haven, Conn.

106,953.—Railway Car Seat.—J. M. O'Neill, Clinton, Iowa.

106,954.—Bed Bottom.—O. S. Osgood, Burlington, Iowa.

106,955.—Latch for Gates, etc.—William Patton, Towanda, Pa. Antedated August 25, 1870.

106,956.—Cultivator.—R. L. Payne, Raceville, Pa.

106,957.—Washing Machine.—L. L. Peck, Portland, Oregon.

106,958.—Water Wheel.—W. S. Place, Charleston, Me.

106,959.—Lubricator.—Hugh Pringle, Greenpoint, N. Y.

106,960.—Saw Mill.—Chester Purdy, Bedford, Ohio.

106,961.—Grain Bin.—Fitch Raymond, Cleveland, Ohio.

106,962.—Water Wheel.—J. R. Richardson, Newcastle, Pa.

106,963.—Stamp Canceler.—G. B. Rogers, Boston, Mass.

106,964.—Apparatus for Pitching Barrels.—Louis Schulze, Louisville, Ky.

106,965.—Steam Generator.—Thomas Sharp and C. S. S. Griffin, Salem, Ohio.

106,966.—Plow.—J. M. Smith, Haddam, Conn.

106,967.—Sky-Light.—S. P. Snead, Louisville, Ky.

106,968.—Apparatus for Hemming, etc., for Sewing Machines.—W. B. Snyder (assignor to the Wheeler & Wilson Manufacturing Company), Bridgeport, Conn.

106,969.—Axle for Vehicles.—A. J. Straight, Richland Centre, Wis.

106,970.—Desk.—C. W. Titus, Philadelphia, Pa.

106,971.—Burner for Locomotive Head-Lights.—A. C. Vaughan (assignor to J. M. Sellers and A. K. McClure) Philadelphia, Pa.

106,972.—Feed Water Heater.—Gardner Waters, Cincinnati, Ohio.

106,973.—Condenser.—Friedrich Wegmann, Naples, Italy.

106,974.—Pump Valve.—G. M. Weinmann, Columbus, Ohio.

106,975.—Straw and Feed Cutter.—August Werner, Buffalo, N. Y.

106,976.—Corn Planter.—Lucius Winston, Pontiac, Ill.

106,977.—Coating Tacks and Nails with Copper.—H. W. Wright, Taunton, Mass., assignor to Albert Field Tack Company.

106,978.—Machine for Elongating and Spreading Saw Teeth.—John Orm, Paducah, Ky.

106,979.—Horse Power Apparatus.—Abraham Gaar Richmond, Ind.

106,980.—Spring for Beds.—Charles Rich (assignor to himself and D. S. Mallory), Poughkeepsie, N. Y.

REISSUES.

4,109.—Spoke Machine.—R. H. Boynton, Oshkosh, Wis.—Patent No. 52,130, dated January 23, 1866.

4,110.—Division A.—Pump.—John Brokenshire, for himself, Kingston, Canada, and George Goble and J. D. Macfarlane, assignees of John Brokenshire, Oswego, N. Y.—Patent No. 80,905, dated August 11, 1868; reissue No. 3,280, dated February 2, 1869.

4,111.—Division B.—Pump.—John Brokenshire, for himself, Kingston, Canada, and George Goble and J. D. Macfarlane, assignees of John Brokenshire, Oswego, N. Y.—Patent No. 80,905, dated August 11, 1868; reissue No. 3,280, dated February 2, 1869.

4,112.—Paring Knife.—J. J. LeBeau, Cincinnati, Ohio.—Patent No. 56,235, dated July 10, 1866.

4,113.—Animal Trap.—J. A. Lee, Chattanooga, Tenn., assignor, through mesne assignments, to R. D. Mann.—Patent No. 83,642, dated November 3, 1868.

DESIGNS.

4,305.—Carpet Pattern.—Jonathan Crabtree (assignor to James Bromley & Bros.), Philadelphia, Pa.

4,306.—Carriage.—A. S. Dodd, New York city.

4,307 to 4,309.—Clock Case.—Bobert Dunn, Brooklyn, N. Y., assignor to Waterbury Clock Company, Waterbury, Conn. Three Patents.

4,310.—Coat and Hat Hook.—W. R. Goodrich, Utica, N. Y.

4,311 to 4,314.—Carpet Pattern.—Alfred Heald (assignor to McCallum, Crease & Sloan), Philadelphia, Pa. Four Patents.

4,315.—Carpet Pattern.—William Kerr (assignor to James Bromley & Bros.), Philadelphia, Pa.

4,316.—Box for the Top of Bureaus.—Cheney Kilburn (assignor to Kilburn & Gates), Philadelphia, Pa.

4,317.—Handle of Spoons, Forks, etc.—John Polhamus, New York city.

4,318.—Cuspadore.—Samuel Roebuck and John Roebuck, Brooklyn, N. Y.

4,319.—Plate and Door of a Cooking Stove.—I. A. Sheppard, Philadelphia, Pa.

4,320.—Portable Range.—David Stuart and Lewis Bridge (assignors to Stewart, Peterson & Co.), Philadelphia, Pa.

4,321.—Frame of an Emery Grinder.—Abijah Wallace (assignor to the Tanite Company), Stroudsburg, Pa.

4,322.—Carriage Boot.—Edward Wells (assignar to Wells, Crittenden & Co.), New Haven, Conn.

4,323.—Carriage-Door Handle.—D. W. Thomas (assignor to Henry Brewster, J. W. Button, and James Lawrence), New York city.

EXTENSIONS.

Sewing Machines.—Extended by an Act of Congress, Approved July 14, 1870.—John Bachelder, of Boston, Mass.—Letters Patent No. 6,439, dated May 8, 1849; reissue No. 617, dated November 2, 1858; extended seven years; again reissued, No. 1,543, dated September 22, 1863, and again reissued, No. 2,125, dated December 12, 1865.

Printing Press.—Richard M. Hoe, of New York city.—Letters Patent No. 15,501, dated Angust 5, 1856; reissue No. 3,893, dated March 22, 1870.

Machine for Manufacturing Spools.—A. D. Waymoth, of Fitchburg, Mass.—Letters Patent No. 15,446, dated July 29, 1856.

Water Closets.—W. S. Carr, of New York city.—Letters Patent No. 15,474, dated August 5, 1856; reissue No. 978, dated June 12, 1860.

Ore Washer.—Hezekiah Bradford, of Reading, Pa.—Letters Patent No. 15,544, dated August 12, 1856.

Lightning Rods.—David Munson, of Indianapolis, Ind.—Letters Patent No. 15,491, dated August 5, 1856.

Lime Kilns.—Levi Averill, of Elmira, N. Y.—Letters Patent No. 15,549, dated August 19, 1856.

Hand Seed Planter.—J. H. Jones, of Rockford, Ill.—Letters Patent No. 15,610, dated August 26, 1856.

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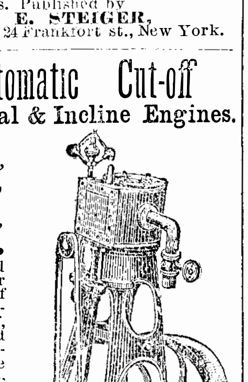

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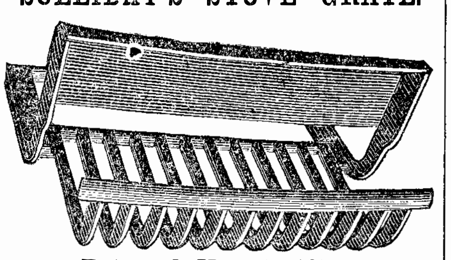

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References on application. E. E. ROBERTS & CO.,
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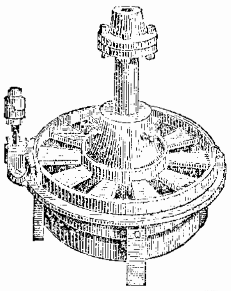

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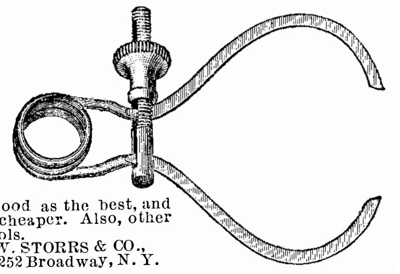

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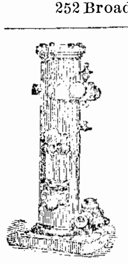

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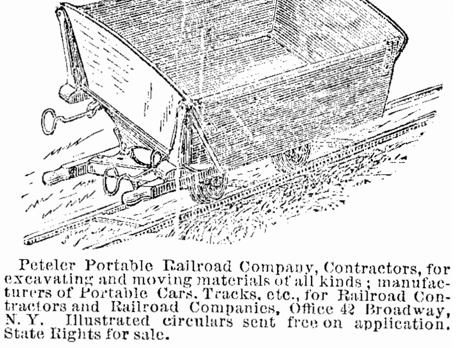

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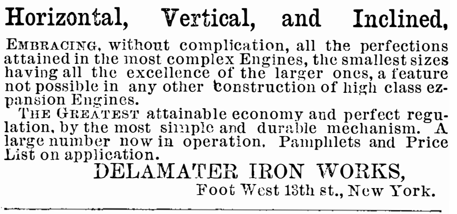

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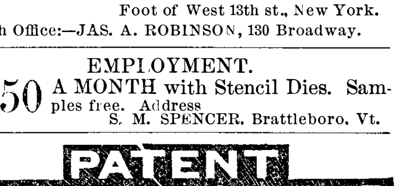

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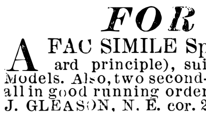

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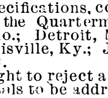

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