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Sternberg's Electro-Magnetic Regulator for Dampers and Valves.

This is an ingenious and scientific device for the automatic regulation of the temperature of public buildings, hospitals, factories, school-houses, dwelling-houses, malt-houses, drying-houses, etc., etc., to any point desired; the automatic regulation of the temperature of any liquid undergoing the process of evaporation or distillation; the automatic regulation of the pressure of steam, so that an engine may be run at any desired pressure; and the automatic regulation of the hight of any liquid in a reservoir from which there is a variable flow, as in a steam boiler.

Fig. 1 shows its application to the regulation of heat in dwellings, public buildings, etc., as will be described below.

Fig. 2 shows its application to the regulation of temperature in heated liquids in chemical and pharmaceutical operations.

Fig. 3 gives a detailed view of the thermometer employed in regulating temperatures in the rooms of buildings.

Fig. 4 is a detailed view of the thermometer employed in regulating the temperature of liquids.

In the latter figure, A represents the bulb; B, a platinum wire fused into the glass, and communicating with the mercury in the bulb; C, the point of junction of the mercury in the stem with a wire, D, which passes through a small aperture in the upper part of the stem. This point of juncture can be raised or lowered as desired by raising or lowering the wire, D.

Fig. 3 represents essentially the same arrangement mounted upon a proper support, and provided with adjusting rollers at the top by which the wire, D, is conveniently raised or lowered till its lower end stands at any desired degree of the scale, and with screws to hold the conducting wires, E F. It is obvious that if the wires, D and B, are connected through conducting wires to the poles of a galvanic battery, the circuit will be made every time the mercury rises to the wire, D, and every time the mercury falls below D, the circuit will be broken.

In Figs. 1 and 2 these wires are shown so connected, with suitable constant batteries. The making of the circuit by the rise of the mercury to the lower end of the wire, D, previously adjusted to the required degree of temperature, develops magnetism in an electro-magnet, which, attracting an armature attached to an unlocking apparatus, releases a train of spring clock-work which operates to close the damper of a furnace, as shown in Fig. 1, or to partially close a gas tap, as shown in Fig. 2, where the operation of heating liquids by the well-known Bunsen burner, generally used by chemists, is shown in progress.

A simple arrangement, not necessary to be dwelt upon in detail, reverses the motion of the clock-work, and opens the damper, or gas tap, whenever the mercury again falls below the end of the wire, D, and the armature is released from the electro-magnet by the breaking of the circuit.

The combustion then increases, and the heat speedily raises the mercury to D, and makes the circuit again. Thus the temperature can never rise above or fall below the degree to which D is adjusted, except to a very slight and immaterial extent while the apparatus is in adjustment.

The clock-work only requires winding for every twenty-four hours of service, but of course this can be so constructed, if desired, as to run a much longer time. Twenty-four hours are, however, ample for most purposes.

It is obvious that this principle may be extended to a great variety of apparatus and operations in the industrial arts. In fact its possible and useful applications are almost beyond enumeration.

In distilling, especially in fractional distillation, in oil refineries, in green houses, hospitals, school-rooms, churches, in the drying of substances at fixed temperatures, in breweries, and malt houses, etc., etc., its use would change uncertainty to precision, and render easy what are now oftentimes some of the most difficult and critical of industrial operations.

In a sanitary point of view, its general adoption as a regulator of temperatures in dwellings and public buildings seems very desirable.

We have personally inspected the operation of this ingenious instrument in the operation of heating liquids for pharmaceutical purposes, and can vouch that in this respect it is all the inventor claims for it. We see no reason why it should not perform just as satisfactorily in regulating the heat of rooms and in other operations.

The device is covered by several patents, dating from March 1, 1870, to July 12, 1870. The patentee is Mr. Geo. M. Sternberg, No. 19 Platt street, New York city.

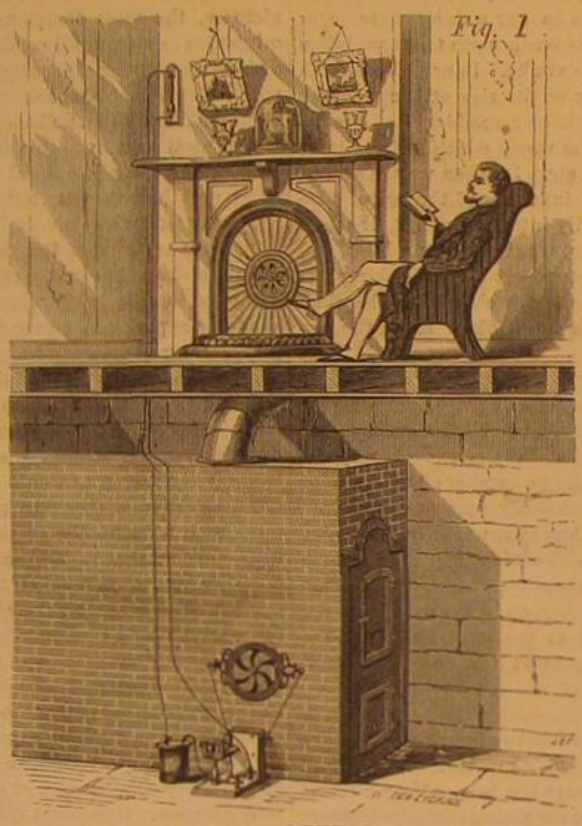


Fig. 1

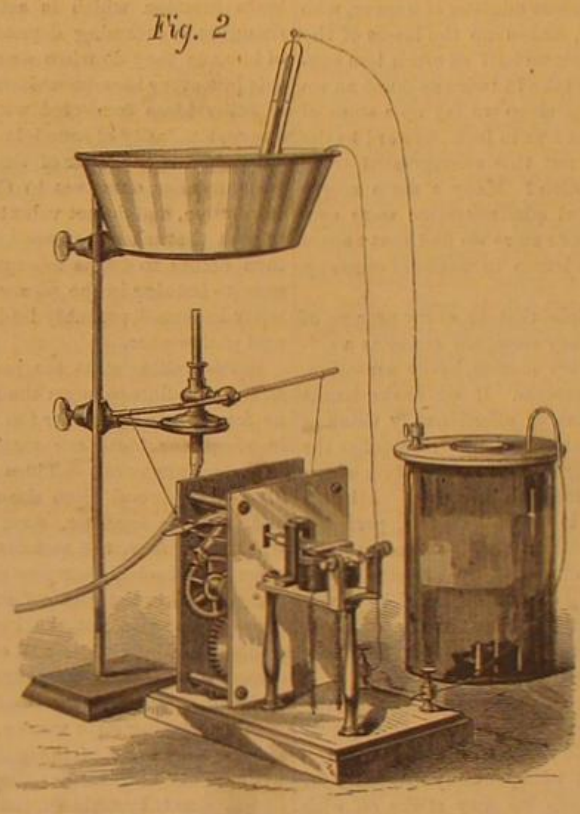


Fig. 2

STERNBERG'S ELECTRO-MAGNETIC REGULATOR.

Hirn's Telodynamic Cable.

The following, in reference to the transmission of power by belts of wire rope and pulleys, is from Prof. Barnard's Report on the Paris Universal Exposition. We have already discussed this subject, but its importance entitles it to further consideration.

"The invention of Mr. Hirn was first applied in the transmission of moderate powers to moderate distances. Instead of a cable there was used in the beginning a band of steel, having a breadth of about two and one half inches, and a thickness of one twenty-fifth of an inch. This presented two inconveniences. In the first place, on account of its considerable surface, it was liable to be agitated by the winds; and, secondly, it soon became worn and injured at the points where it was riveted. It served, however, very well for eighteen months to transmit a twelve-horse power to a distance of eighty meters (266 feet). A cable was then substituted, and this, first introduced in 1853, is still in good condition.

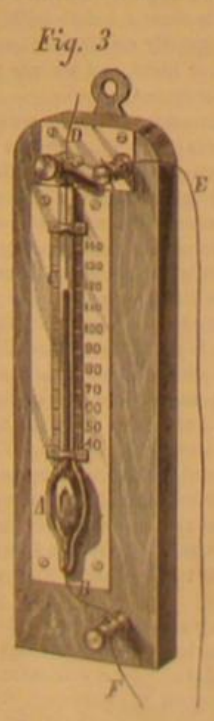


Fig. 3

Fig. 4

"It was in the attempt to extend the system to greater distances that difficulties and obstacles began to be encountered. At the distance of eighty meters no intermediate supports were necessary. At the distance of two hundred and forty, to which the system was next extended, such supports were found to be indispensable in order to prevent the cable from dragging on the ground. It was only when, after the many trials and failures above mentioned, a material had at length been discovered which rendered these supports indefinitely durable, that this second experiment could finally be pronounced completely successful. After this success, however, the extension of the system went on rapidly. A single firm, Messrs. Stein & Co., of Mulhouse, have applied it in more than four hundred instances with entire success. These applications have been made for the most part in France, and the department in which the invention originated, but there are some noticeable exceptions. The Government manufactory of powder at Okhta, in Russia, mentioned above, has introduced it for the transmission of the force of its turbines over a distance of one thousand four hundred meters. Several establishments in Germany employ it for distances varying from three hundred and fifty to one thousand two hundred meters. An officer of the Danish navy has made one application of it on a line of one thousand meters; and at the mines of Falun, in Sweden, a more than one hundred-horse power is transmitted by it to a distance of five thousand meters (1,608 meters make one half of our miles, so that the latter distance would be nearly three and one eighth miles).

"The invariable success of all the applications hitherto made, over distances constantly increasing, has satisfied the inventor that power can be economically carried by this method as far as to ten or fifteen miles. The experience thus far acquired has furnished data by which the loss attendant on transmission can be very closely calculated. This loss, which will of course increase with the distance, may be referred to three sources, viz.: the friction on the axles of the pulleys, the rigidity of the cable, and the resistance of the air. Experimentally it is found that, for the two great pulleys at the termini, an allowance must be made of two and one half per cent, and for the intermediate pulleys and the rigidity of the cable there must be allowed additionally one per cent for each thousand meters. Thus, for one hundred-horse power carried to a distance of ten kilometers, or six miles, the loss will be $2\frac{1}{2} + 10 = 12\frac{1}{2}$-horse power, or one eighth of the whole; the resistance of the air being still to be added. Mr. Hirn makes allowance for this by doubling the last sum; so that one hundred-horse power may, in his opinion, with perfect certainty, be carried six miles without losing more than twenty-five per cent. This is undoubtedly an under-estimate."

Passage of Gases in the Body.

At the concluding lecture of his course on experimental medicine for the session 1869–70, Dr. Richardson made, says the *Lancet*, a very curious experiment, which appears to show that there is a direct and almost immediate passage of substances in the gaseous form through all the tissues of the body, and especially through the coats of veins. Dr. Richardson introduced a fine tube through the nostril of a rabbit into the cranial cavity. Air, or carbonic acid gas, pumped through this tube, instantly made its appearance in the right cavities of the heart. The carbonic acid darkened the blood and stopped the systolic action. Atmospheric air rendered the blood of the right side arterial, and restored the systole. It seems, therefore, that we are not air-tight.

Improvements in Steam Navigation.

Mr. Jas. Granger, the inventor of a feathering paddle wheel for steamers, illustrated in No. 5, Vol. XIX., of the SCIENTIFIC AMERICAN, writes in answer to C. E. Haskins' query, in regard to the present stand-still in improvements in steam navigation, that the reason is mainly attributable to the fact that attention has been too exclusively directed to the improvement of the old-style wheel and screw, instead of endeavoring to construct other and better means of propulsion.

ON THE SCIENCE OF SLEEP AND DREAMS.

From ancient times sleep and dreams have been regarded by philosophers and students of nature with the deepest interest. It is, therefore, the more remarkable that until very recently one of the most important questions in connection with the theme—namely, the cause of sleep and the reason of its periodical return, has been but very imperfectly answered. Two years ago Professor Pettenkofer, of Munich, a gentleman widely celebrated for his researches into the cause of cholera, in the course of his experiments upon the exchange of gases in the human system, gave a perfectly satisfactory reply to the inquiry.

It has long been known that the oxygen taken in during the act of breathing plays a very important part, inasmuch as through its union with the substance of our bodies the vital forces are generated. In every process of life, however insignificant, a certain quantity of oxygen is consumed. It is, in a sense, the steam power by which the living machine is driven, and the amount used can be measured by the quantity of carbonic acid generated and set free in the act of expiration. For this purpose Pettenkofer, assisted by Voit, has contrived an apparatus, and has thereby brought to light the unexpected fact that during the day, even with the slightest efforts, we give forth proportionately much more carbonic acid, or, in other words, consume much more oxygen than we receive during the same period.

From this interesting fact there naturally arises the important inquiry, by what means is this daily deficiency supplied? Here, also, Pettenkofer's researches furnish us with a satisfactory answer. Sleep is the prudent minister of finance, who every night, by a wise economy, makes up the losses of the day, for in sleep we not only consume half as much less oxygen as we do in the day, but we take in twice as much as we do when we are awake. During sleep we lay up a store of oxygen which enables us without fear to look forward to the deficiency of the morrow. Is not this arrangement truly worthy of our warmest admiration? Many a state might congratulate itself if its financial administration were conducted on similar principles. Once more we find that nature is the best teacher, giving us a lesson in national economy from the philosophy of sleep.

We have laid down the principle that in every process of life, no matter how trifling it may seem, we consume a certain proportion of oxygen. Every motion, every sensation, even every thought is such a process. If we shake hands with a friend, if we look at him, or affectionately think of him, our heart beating quicker at the thought, we suffer the loss of a definite quantity of oxygen; a certain portion of our body is consumed and changed into carbonic acid. All this sounds horribly material, but it is, nevertheless, perfectly true, and is sustained by the best possible proofs—namely, those arising from the economy of the human system. During sleep its task is to be sparing of oxygen, and like a wise householder, who avoids all useless and luxurious indulgence, and limits himself to such expenditure as is necessary for his subsistence, it faithfully performs it.

But what are these things which we may regard as the luxurious expenditure of our organism? Above all we must include in this category the whole range of the activity of the senses, since such activity is not indispensably necessary for the maintenance of life. In sleep we may strike off with comfort the charges connected with sight. The muscles of the eyes first refuse their service. A peculiar feeling of pressure and heaviness in the upper eyelids informs us that they are preparing for sleep, and the impossibility of fixing the eye steadily upon any object betrays to us the fact that the muscles which cause the convergence of the axis of sight can no longer perform their part. With the closing of the eyelids the excitement of the retina ceases, and the nerves of the eye sink into repose.

The next organs which cease their activity during the process of falling asleep are the ears. Possessing no closing apparatus like the eyes they do not so easily enter into a state of rest. Here, so to speak, sleep has to struggle for its rights. The best example of this we may find in our own experience, if we have been so unfortunate, or shall I say fortunate, as to fall asleep under a tedious lecture or sermon. After we have gradually lost the thread of the discourse, and our eyes are enjoying their well-earned rest, the words still continue to sound in our ears, but we are no longer in a condition to recognize and understand them. Gradually they become more confused, and at length end in a dull and inarticulate murmur which seems to withdraw itself farther and farther from us, until at last it is entirely lost.

In the meantime the sensitiveness of the skin begins to be lessened. In vain our friendly neighbor wearies himself to save us from the annoyance of falling asleep by gently pushing us and treading upon our toes. All his efforts fail. Sensation, if not altogether lost, is so materially lowered that it will respond only to strong provocation. The senses of smell and taste cease their activity, and so at length we are pretty well relieved of all our five senses.

At last the muscles controlled by the will sleep also. When we sleep in a comfortable bed we are hardly conscious of this, and the best opportunity for observing it is when wearied by an uninteresting discourse, we must sleep sitting. Who has not been grieved to find the impertinent muscles of his neck suddenly refusing to carry his head upright? And as long as the struggle between sleeping and waking is continued, there is exhibited to the mischievous spectator the highly amusing but treacherous nodding of the head.

Thus the body has, like a frugal housekeeper, discharged its obligations, and unsparingly reduced all expenditure for mere pleasure and luxury. But this is not enough; it materially curtails the charges for the nourishment of its tissues and the renewal of its substance. The action of the heart is diminished to a speed varying from three to ten strokes; the blood comes less often into contact with the general structure, and, therefore, imparts to it less oxygen. Naturally, therefore, the functions of the bodily organs generally are limited, and, above all, suffers that very important organ, the brain, of which we must further speak.

The brain is that organ by which we discharge our mental functions. Whether our views are materialistic or spiritual, we must adhere to the principle that mental activity is inseparably connected with the brain. It is the instrument by which the soul manifests its activity, and, as from an imperfect instrument the most skillful performer can produce only imperfect music, so the capabilities of the mind are dependent upon the state of the brain. As in sleep its nourishment is considerably lowered by the diminished supply of blood, so also, as Durham's experiments upon sleeping animals, whose skulls he partially opened, have shown, the arterial, that is, the oxygen bearing vessels, are more contracted and less abundantly filled than in the waking condition, and, consequently, the capability of the brain is much less. Mental activity is reduced to a minimum, and especially must all complicated processes, above all things the judgment, come to a pause. Still our thoughts and ideas continue to spin themselves out even in sleep, according to the same indestructible law as they do when we are awake, but they lack the regulating and limiting conduct of the judgment and the understanding. This partial activity of the brain is to dream.

The dream is not a dark and inexplicable something of whose origin we are ignorant; it is a product of the same brain function which is active in our waking state. Our thoughts in dreaming depend as much upon the association of ideas as they do when we are awake. In accordance with this law every idea immediately on its rise calls up a series of other ideas connected with it by resemblance of circumstance, similarity of sound in the words which express it, or agreement in the order of time, etc. If, when we are awake, we surrender ourselves to the influence of the law of idea association, and do not voluntarily interfere with it, it comes to pass that when we hear a shot we think of the hunt, and then occurs to us the newspaper report that the king has gone to indulge in the pleasures of the chase, and the similarity in sound probably leads us to think of King, the natural philosopher.

In the waking state the judgment always exercises a restraining influence upon the play of our fancy, and prevents us from joining together the unusual and incongruous; but in sleep our ideas are associated in the lowest manner. When we are awake one idea follows another; but when we are asleep, several ideas simultaneously present themselves, and, uniting together, form themselves into one complex whole; or, from the rapidity with which they follow each other, and the indistinctness of their connection, one idea unobserved takes the place of another, and then we see in the above illustration not the king at the hunt, but King, the philosopher, and thus are originated the most wonderful dream combinations, the source of which we seldom succeed in discovering.

In the waking state we can, as I have already said, call up ideas by an effort of the will. We can think of what we wish. This, however, is not always the case. Very often it happens, as if by accident, that ideas spring from the treasure of our memory to which we voluntarily give further entertainment, or by which we are unwillingly led to other ideas distasteful to us. So also in dreams, where the voluntary calling up of any given idea is impossible, the mind is led to involuntary activity by means of ideas stored up in the memory. Most frequently the first impetus to a series of dream-pictures is given by some marked and striking impression which has been made upon us during the day, or by thoughts which have occupied our minds shortly before falling asleep. These ideas are often uninterruptedly continued; but not less often we are rapidly led to other ideas, and we are then unable to detect the connection between the two.

When we are awake the impressions of the senses are by far the most prolific source of mental activity. But in sleep, as we have seen, the senses have ceased to exercise their functions, though still, to a certain extent, capable of excitement. Under strong impressions the senses of hearing and of feeling are susceptible even in deep sleep, but the resulting idea is almost always confused, and often an entirely different image is presented; just as in the twilight we sometimes take the trunk of a tree for a man sitting by the wayside. The indistinctness of the impression made upon the senses allows the fancy to fill it up in its own colors, and so it comes to pass that any excitement of the sense of hearing or feeling in sleep gives occasion for dreams, of which only the most general outline originates in external conditions. There are many examples of this on record. Meyer narrates that he once dreamed that he was attacked by robbers, who laid him full length on his back upon the ground, into which they drove a stake, passing it between two of his toes; but on awaking he found that those two members were only separated by a straw!

Another relates that, having a bottle of hot water placed at his feet, he dreamed that he had reached the top of Etna, and was treading on burning lava. In a similar manner, if we are uneasy in bed and throw off the covering, we dream that in the cold of winter we are wandering half clad through the streets; or, if there is a strong wind blowing, we dream of storms and shipwreck; or a knocking at the door produces dreams of an attack by thieves. It is very seldom that words spoken in sleep are distinctly understood, and equally seldom that they call up in the mind of the sleeper the idea they represent. I may mention an instance or two in which dreams could be controlled in this way. Dr. Abercrombie relates that an English officer who accompanied the expedition to Ludwigsburg in 1758 dreamed, to the great delight of his comrades, any kind of dream they chose, according to the words they whispered in his ear. Another example is given by Kluge: A rejected lover, who had secured the favor of the lady's mother, obtained permission to whisper his name in her ear while she slept. Very soon there was a remarkable change in her conduct towards him, and at last she gave him her hand. On being questioned about the change, she replied that she had become attached to him in vivid and oft-repeated dreams. For the truth of this story we cannot vouch; at the same time we do not deny its probability; and any one who pleases may, as a last resort, try its effect upon the heart of his beloved.

The excitement of the internal susceptibilities gives occasion for dreams almost more frequently than the external senses. By internal susceptibilities I mean those sensations which indicate to us the position of our internal organs, and which are usually known as general feelings, and to which belong the condition of being well and unwell. In perfect health we are not anxious of the action of our various organs. We do not feel that we have a stomach or a heart or muscles, etc.; but as soon as there is any functional disturbance of these members, to say nothing of the pain by which it is sometimes accompanied, we are made aware of their existence by a certain undefined sense of uncomfortableness. These sensations come within our consciousness during sleep, but, as might be expected, darkly and indistinctly. Connected with them in a similar manner as with the impressions of the external senses, are certain symbolic dream-pictures, the most common of which is nightmare. This originates in a cramped condition of the respiratory muscles, and a consequent difficulty of breathing. Similar results will follow if the stomach be overloaded, for it then presses upon the diaphragm, and thereby confines the lungs. When we are awake we trace this disordered respiration to its correct cause—namely, a local affection of the organs of the chest, and there it ends; but in sleep we are incapable of this reasoning, and therefore, in harmony with the law of association, there arises from the feeling of oppression the idea of weight and the image of a superincumbent object. We also dream of heavily laden wagons passing over us, or of dark, shadowy apparitions emerging from the ceiling, and gradually settling down upon us.

Not unfrequently we find that, instead of this, we dream of some great trouble or sudden fright, for in the waking state experiences often render respiration difficult. We then dream, for example, that we are attacked by robbers; and when we endeavor to secure our safety by flight, we find, to our consternation, that our feet refuse to serve us, and we remain, as it were, rooted to the ground. We try to call for help, but find that we are unable to produce a single sound, until at last, after long struggling, the muscles of respiration are released from their restraint, and we awake—sometimes with a loud cry.

In a similar manner is experienced the dream of falling from a great hight. It usually happens while we are falling asleep, and depends upon the circumstance that the gradual relaxing of the muscles caused by sleep is, by some momentary excitement, reversed, and the result is a shrinking back of the body similar to that experienced in falling from any lofty position. Somewhat different from this is the dream of flying. According to Scherner it depends upon our consciousness of the action of the lungs, their rising and falling motion giving to us in our dream the notion of flight. There are a great many more conditions of the body which, if they come into our consciousness during sleep, awake in us, in harmony with the law of the association of ideas, a certain kind of dreams. The emotions also produce a definite impression upon their character. "Great joy," some one has written, "originates a different class of dreams than great sorrow; and ardent love gives rise to dreams not produced by hatred, deep repentance, or an accusing conscience."

If we accustom ourselves attentively to notice our dreams, we shall easily perceive the confirmation of the law laid down. But we shall also find that it is exceedingly difficult to reproduce a dream correctly. It is so for two reasons. The imagery of dreams, in by far the greater number of cases, is so indistinct and shadowy, and in its particulars so inadequate, that, by the effort to recall them, we involuntarily bring to our help the imaginative power of our waking moments, and thereby give to them definite color and outline. The other reason is, the innate tendency of the human mind to look at all things in their logical connections. When our dreams consist of a series of pictures, often connected only by the very loose bond of the association of ideas, we bring to them by their reproduction, unintentionally, of course, a logical connection and correspondence with real life which originally they did not possess.

During the period of deepest sleep the function of the brain is so weakened that we retain no recollection of it, and sound sleep has, therefore, come to be called a dreamless sleep. Sometimes we know that we have dreamed, but are wholly unable to recall a single trace of that which has engaged our sleeping thoughts. But shortly before we awake, when the oxygen stored up in the blood corpuscles begins to bring the process of waste and repair in the brain into more energetic operation, our dreams become more lively and connected, and, for this reason, are more easily retained by the memory. The cases are very few in which dreams are so vivid that we are unable to distinguish them from real events. Professor Jessen, a celebrated physician to the insane, gives a striking example, in the following words:

"One winter morning, between the hours of five and six, I was awoke, as I believe, by the head keeper, who informed me that the friends of a patient had come to remove him

and at the same time he inquired whether anything required mention. I replied that he might permit the patient to depart, and immediately lay down again to sleep. I had no sooner done this than it occurred to me that of the intended removal of this patient I had heard nothing, but that it was of the departure of a woman of the same name I had been advised. I was compelled, therefore, to seek further information, and, having hastily dressed myself, I went to the dwelling of the keeper, whom, to my astonishment, I found only half clad. Upon my asking him where the people were who had come to fetch away the patient, he replied, with surprise depicted in his countenance, that he knew nothing of it, for he had only just risen, and had seen no one. This reply did not undeceive me, and I rejoined that it must have been the steward who had visited me, and I would go to him; but as I was descending the steps which led to his house it struck me that the whole affair was a dream—a fact, however, which I had not until that moment suspected."

This example is particularly interesting from the length of time which elapsed after the professor awoke, and during which he had been thoroughly aroused by the act of dressing and going to the keeper, yet the delusion which regarded the dream as a reality continued, and at last, without any apparent cause, suddenly vanished.

Proportionately more frequent are the cases where the awaking is imperfect, but still sufficient to induce a course of action corresponding with the supposed realities of the dream. There are instances on record where people, deceived by the alarming imagery of a dream, have committed acts of violence for which they could not be considered responsible.

An interesting example of insubordination during heavy sleep is related by Büchner, in Henke's *Journal of Medical Jurisprudence:*

"Christian Jünger, a soldier of the guards, two and twenty years of age, and who had been three years in the army, a man of good character, fell asleep about noon upon a bench in the guard house. The corporal endeavored to awake him, in order to sweep out the room. Jünger arose, and, without saying a word, seized the corporal by the breast, then drew his saber and made an attack, which the corporal succeeded in parrying. He repeated the attempt, however, and did not desist until disarmed and arrested by the soldiers present; he then sat down quietly upon the bench. On the preceding day, and on the morning of the deed, he had kept guard at an exceedingly cold and exposed situation; the intervening night he had spent in playing at cards, but had drunk little, and in the morning, from sheer weariness, he fell asleep in the heated guard house. On the examination it appeared that he dreamed he was on guard, when a follow seized him by the hair, and took his rifle, upon which he drew his saber and made an attack upon him. Of that which really passed he knew nothing. He could not understand that he, who had always been obedient to his superiors, should have been guilty of insubordination. The medical evidence showed it to be a case of 'sleep-drunkenness,' and he was acquitted."

In explanation of this case something further may be said. Similar results might be brought about by toil of any kind; but here, by keeping guard, and the consequent excessive exhaustion, the deficiency of oxygen was brought to an abnormal hight, and the small quantity taken in during the short sleep was not sufficient to restore the brain to its full activity. The oxygen still remaining was needed to supply the demands of the comparatively insignificant activity of the impulses of the will, so that the deliberative faculties and the voluntary thoughts could not come into play. We frequently see this confirmed when we wish to awake any one out of sleep. Before he come to perfect consciousness he throws himself about in bed, and stretches his limbs, until at last free thought again asserts its authority over the brain, and consciousness is fully restored.

But we sometimes have phenomena presented to us which are the opposite of this. As Aristotle has already remarked, we are often in a position during sleep to recognize a dream as such. An interesting self-inspection of this kind is related by Beattie. "I once dreamed," he says, "that I was upon the parapet of a very high bridge. For what purpose I had come thither I could not perceive, and when I considered that I had not been inclined to such performances, I began to think that it was only a dream. Wishing to be free from this disturbing and tormenting illusion, I threw myself down, in the expectation that I should be brought back to reason by the fall, which indeed happened." In this example the dream occurred shortly before awaking, and the store of oxygen had manifestly reached such a hight that the organ of thought could act in a limited manner, while at the same time the association of ideas produced in the dream continued.

The same thing has been observed by almost every one in the voluntary effort to prolong a pleasant dream just before waking. In this case, also, the organ of thought is fully capable of exercising its function, but we are in a position to control it a little longer, and to permit the fantastic association of ideas commenced in a dream to continue itself. But when once the activity of free thought has broken in upon this play of the fancy all is over with the dream, and we are irrecoverably awake.

We are restored to the waking state when the supply of oxygen has reached its highest point, and the exchange of substance again comes into full operation. It is possible, however, as every one well knows, to be awoke before this by external influences. Any strong excitement affecting either the nerves of hearing or of feeling or of seeing, by the propagation of that excitement places the brain in a condition which promotes a more plentiful flow of blood, and in consequence of this, an accelerated change of substance, which, on reaching a certain stage, results in perfect wakefulness. Sleep requires, as we have observed above, that the arterial blood-vessels should be but sparingly supplied, and everything which increases the supply of blood to the brain not only prevents falling asleep, but disturbs the sleeper. Therefore, all passion and agitation of the mind, all anxious pondering, or bodily or mental excitement—in a word, everything which drives the blood to the head drives away sleep; on the other hand, whatever takes blood from the brain and contracts its vessels is favorable to sleep. It is in this way that cold bandages applied to the forehead are often successful, for cold causes a contraction of the blood-vessels.

In this connection we must not forget the so-called sleep-producing medicines, especially opium and its alkaloids, among which morphia and narcine take the first rank. From certain experiments it has been concluded, and with great probability of correctness, that opium acts upon the vessels of the brain as an astringent, and thus diminishes its supply of blood. But by such means as these we can secure only a smaller consumption of oxygen in the brain; we cannot at the same time cause more oxygen to be taken in and laid up in the blood corpuscles for future use, for just in those circumstances in which we are compelled to resort to such methods of procuring sleep, the capacity of the blood corpuscles for storing up oxygen, as Pettenkofer's researches in cases of sickness have conclusively shown, is diminished. And so it comes to pass that sleep obtained by means of an opiate is never so refreshing and invigorating. In ordinary circumstances the avoidance of the above-mentioned condition inimical to sleep will suffice to procure it. Here habit plays a very important part. Usually we do not wait for the complete exhaustion of the oxygen of the system, but fall asleep, if we have been accustomed to do so, when it has reached a certain limit. For the same reason we are capable of being awoke at any moment. There is always a reserve fund of oxygen, which makes waking possible. In those cases in which, through excessive watching, the exhaustion of oxygen has reached its extreme limit, the sleep following is so deep that before a certain time has elapsed it is hardly possible to disturb it.

It is not always in our power to avoid those things which hinder sleep, and above all it is only seldom that we can exercise complete control over our mental states. To do this requires either a good deal of stoicism, or an uncommon strength of will and power of self-government. It is said that Napoleon I. could sleep at any time he chose, and did so even during the battle of Leipzic. He had the gift not only of controlling his feelings, but also of suspending thought at pleasure. That the last achievement is by no means an easy one almost everybody has experienced. If some thought or plan occupies the mind we cannot sleep, and we must then endeavor to direct our thoughts to those things which excite but little interest; in other words, we must endeavor to become tedious to ourselves. For this purpose there exists the greatest variety of ingenious methods, and as it does not come within my plan to increase the number of them by this paper, I will here close with the hope that it has awakened in the reader an interest in the phenomena of life as manifested in sleep and dreams.—*Ewald Hecker in the Chemist and Druggist.*

How to Make Bone Fertilizers.

The United States Agricultural Department, having been applied to of late by many of its correspondents to issue some general instructions by which farmers might manufacture their own manures, has prepared the following, accompanied by such remarks as would make the manipulation intelligible:

Bones are almost completely insoluble in water—practically so. When very finely divided, as in fine bone dust, a small amount is dissolved by the water of the soil containing carbonic acid, but the quantity is small, and the time taken to do it is great. For the useful effects of bones, therefore, the farmer must dissolve them, and sulphuric acid is alone the most powerful and economical means for that end. It depends on the different form of bone which the farmer operates on as to how much acid will be required. The sulphuric acid used should be of considerable strength, and the farmer should ask for it of the specific gravity of 1·70 or marking 140° Twaddell.

When the acid reaches the bones, the mass effervesces, boils up, and becomes warm, the sulphuric acid taking away two thirds of the lime of the bone from the phosphoric acid, which remains united with the other third, forming a superphosphate, biphosphate, or mono-calcic phosphate, which substance is perfectly soluble in water, and is called soluble phosphate. The sulphuric acid uniting with the lime forms a sulphate of lime (gypsum, or plaster). So that in every heap in which a superphosphate has been made there is always an amount of sulphate of lime (plaster) formed, and the plaster forms the greater portion of the whole mass.

The bones which are used for making superphosphates by manufacturers, or which may be had by farmers, are found in the following conditions: 1. Bone dust or ground bone. 2. Boiled or steamed bones. 3. Bone ash of sugar refineries.

1. BONE DUST.—Before the bones are crushed they are now generally boiled for the sake of the fat, which is sold to the soap boiler. It is of no value as a manurial agent, but is rather deleterious, coating the bone and protecting it from the action of the acid, and it would be advisable for the farmer when possible to boil the bones.

2.—BOILED OR STEAMED BONES.—Bones are steamed for the purpose of removing gelatin or animal matter of the bone for the purpose of converting it into glue. The effect of steaming on bone is therefore to deprive it of some of its organic matter, but it must not be supposed that the whole of the organic matter is removed; a considerable quantity remains, and some ammonia can always be found in such bones when decomposing. A reference to the analysis shows that not more than five or six per cent of organic matter has been extracted from the bone.

3.—BONE ASH.—If bones are burned in contact with the air, the greater part of the carbon is driven off with the other combustible parts of the bone. To avoid this result, which would render the ash worthless for the use of the sugar refiner, the bones are charred in heated iron cylinders, out of contact with the air, by which only a portion of the animal matter is burned off. A large amount of finely-divided charcoal remains, mixed with the bone earth, giving the valuable properties to the bone ash. It has become a great deodorizer and an antiseptic, and capable of condensing gases within its pores, by which means it retains both the ammonia and nitrogen of the soil and the manure. The black color of the bone ash is due to this charcoal.

	Voelcker.		Anderson.
	Bone dust.	Steamed bone.	Bone ash.
Moisture	12·06	8·06	6·10
Organic matter*	31·13	25·45	5·05
Phosphates of lime and magnesia (bone earth)	44·54	60·48	79·29
Carbonate of lime	4·99	3·25	4·05
Magnesia and alkaline salts (chiefly common salt)	1·91	·43	·15
Sand	·38	2·33	5·45
Total	100·00	100·00	100·00
* Containing nitrogen	3·69	1·84	.....
Equal to ammonia	4·49	2·24	.....

One hundred pounds of bones, ground, crushed, or dust (not burned), require forty pounds of sulphuric acid (vitriol). This quantity, if acting solely on the bone phosphate, would remove two thirds of its lime; but, as there is always some carbonate of lime present, this is first acted on by the acid, and thus some of the phosphate escapes decomposition, and remains in the mass as insoluble phosphate; hence, in the mass there are always three constituents, the amount of which it is desirable the farmer should know, namely: The soluble phosphate (mono-calcic phosphate), the insoluble phosphate of lime (undissolved bone earth), and the sulphate of lime. These are the three important substances in a superphosphate, for although ammonia may be potentially present if raw bones have been used, yet a superphosphate is not made or used for the sake of the ammonia; and when bone ash or burnt bone is used, no ammonia is required.

If calcined bones, or bone ash of the sugar-house, be the material used, every 100 pounds will require 87½ pounds of vitriol; when these have fully acted on each other the mass would give: Superphosphate of lime, 26 pounds; gypsum, 66 pounds; sulphate of magnesia, 1½ pounds; soda, 2¾ pounds, and the balance of the 187½ pounds would be water and undissolved bone earth. If the farmer uses steamed bones, a quantity of vitriol intermediate between the two proportions named will be needed, say 66 pounds.

The usual mode of making the fertilizer is to select a good wooden floor of a barn, well covered overhead, or to make a box floor of thick plank, laid tight. On this first throw the bones. If not in dust, it would be well to sift the bones, and place the coarser part on this floor, putting the finer portion aside for mixing in afterwards. By this means the rough bone will come in contact with the strong acid first and be more effectually divided, while the finer parts can then be added to dry up.

No metal (except lead) should be used on the floor, or where the acid can reach. Water equal to one fourth or one sixth the weight of bone is then to be poured on the bone, well stirred in with a spade, and left for two or three days to heat and ferment; it would be well to use the water boiling. Then add the sulphuric acid, mixing well with a wooden spade or board; the mass effervesces, or boils; stir twice a day well for two days, so as to turn the whole mass over; let it stand for two or three days to dry; add the fine bone, and mix well. If not dry, use some absorbing substance, as sawdust, dry peat, or dry earth, in small quantities, and mix well. Do not use for this purpose lime, ashes, or marl, as they would destroy the superphosphate and spoil the whole work.

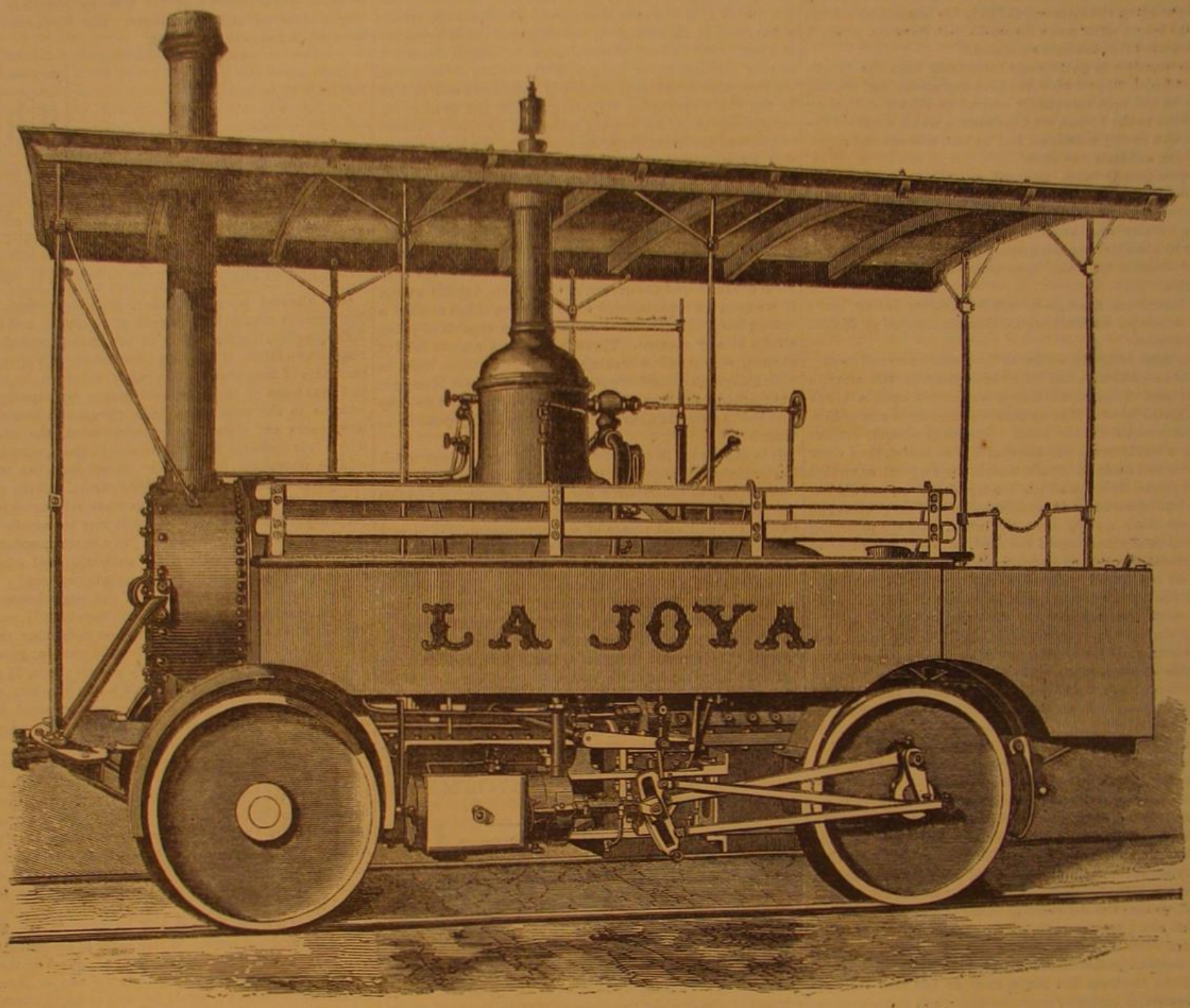
Made in this way from bone ash, this fertilizer will yield 30 per cent of soluble salts, of which 26 per cent is superphosphate of lime. The manufacturer will say that there is 35 to 37 per cent of superphosphate present, but he always over-estimates; indeed, 26 per cent of soluble superphosphates is more than any farmer wants; it is too soluble, and will pass out of his ground too soon, especially in wet weather; 12 to 15 per cent is a better proportion for the farmer, for then he has a proportionally larger amount of insoluble bone phosphate in store for future use in the soil. On this account it is better for the farmer to use raw or steamed bones than bone ash; he has a sufficient, though a smaller, quantity of superphosphate present.

This fertilizer will not suffer from exposure to air, but it must be protected from rain or wet; it ought to be barreled up when not used immediately. This fertilizer, made as directed, will be of a whitish color if made from raw or steamed bone, and gray black if made from bone-black of the refinery; but the color of a superphosphate is of no consequence, and no test of its quality; neither is its smell; it ought to have no smell, or a faint acid odor, if any. One ton of a manure made by the farmer as directed is worth two purchased in the market.

AT the great plow factory of B. F. Avery, Louisville, Ky., they turn out five hundred plows per day. Mr. Avery is one of the oldest plow-makers in the country. He worked originally, in 1825, under Jethro Wood's patent.

MOUNTAIN LOCOMOTIVE.

The very curious little engine illustrated in the annexed engraving was built for a line in Peru, the grades of which are 200 feet to the mile and over, for thirty miles; it is intended for use instead of hand cars, which cannot be used on such grade. The engine has room for ten or more men on the seats over the tanks on each side, and can also draw a small four-wheel car with materials for repairs of the track. The cylinders are 5 inches diameter by 12 inches stroke, the wheels are 30 inches in diameter, one pair only being driven The boiler is of cast steel, ¼ inch thick. The furnace is 30 inches long, 25 inches wide, and 32 inches deep (inside), the crown of the furnace is stayed with screwed stay-



MOUNTAIN LOCOMOTIVE FOR PERU

bolts, the same as the sides. The boiler contains 58 1½ inch iron tubes, 4½ feet long. The axles are cast steel; the tanks hold 142 gallons—they are under the seats; the coal boxes—one on each side, at the rear of the tanks—contain 500lbs. of coal.

The engines of which this is a type are expected to run from twenty to thirty miles an hour.

The first engine of this kind was built by the Rogers Locomotive Works, Paterson, N. J., for the Copiapo Railroad in Chili. It was smaller than the one described above, having cylinders 3½ inches diameter; 10 inches stroke; four wheels, 30 inches diameter, one pair only being drivers. This engine has been run fifty miles in an hour and a quarter with 270lbs. of soft coal. This seems a very high speed for so small a wheel, but we do not doubt the story, as it comes to us from Mr. E. P. Gould, who was superintendent of machinery of the Copiapo Railway at the time. The company were so well pleased with its performance that the Rogers Works have since built them another one, with cylinders 4½ × 12, and 4·28 inch wheels.

The Tanning and Preservation of Fishing Nets.

The fishing nets on the south coast of England are according to the *Journal of Applied Science*, all well tanned with catechu. There is a boiling house with a large copper, into which they are plunged, and thus dyed a dull brown color. One of the most fertile causes of the rotting of nets is letting them lie in a heap while wet. The fishermen at Scarborough and on the Sussex coast are very particular in drying them as early as possible after they have been used. A few hours lying in heaps causes them to heat, and then destruction commences. Nets that are always immediately hung up to dry after having been used, have remained good and sound after twelve or fourteen years' use.

The nets used by the fishermen on the coast of Sussex are either hempen or cotton, and they are always prepared for service before being used. The mode of preparation is different with each description of net. Those made of hemp or flax are simply well tanned and dried before using. Those made of cotton are first well tanned and dried; they are then dressed well with linseed oil and again thoroughly dried; and finally, they are well tarred and again dried before they are fit for use.

This process not only preserves the net, but gives a stiffness to the meshes which makes them work better when in use. The cotton nets, the fishermen say, are more apt to heat when left in a mass than the hempen ones. The process of tanning is carried on in a good-sized square building, furnished with two large coppers, each five feet in diameter and three feet four inches deep.

The material used is catechu. Besides the large copper there are several square tanks of about the same capacity as the copers, and several puncheons with one head out; these are used for the maceration of the nets when they are too busy to allow them to remain in the coppers.

When the nets are new they proceed as follows: They put into a copper one-and-a-half cwt. of catechu, broken up into small pieces, and a sufficiency of water to admit the nets. This charge of catechu is enough to a fleet of nets; that is, about 106 nets, each net thirty-five yards long. The nets are boiled and then allowed to remain in the fluid twenty-four hours. They are then taken out, well drained, and thoroughly dried. After having been used for six or seven weeks the tanning is repeated, but the charge of the copper on the repetition of the process of tanning is only about one cwt. of catechu to the fleet of nets.

The repetition of the tanning is continued as long as the nets last (they say from five to six years if proper care be taken of them), and all necessary repairs are made with netting twine properly tanned for that purpose. The fishermen say, when they come in, in the morning, and go out again the same day, they do not attempt to dry they nets, but they never suffer them to lie in bulk in the boat, but cast them out on shingle and open them out widely, so that there be not bulk enough together for them to heat. When the season is over they tan them again thoroughly, and then store them away.

The fishermen's clothing, when made of canvas, is tanned previous to wearing, which makes them last at least twice as long. To prepare such articles, an ounce or two of catechu is bruised and boiled in a large saucepan or small copper, in which the clothes are immersed in the same manner as the nets.

Of the Acacia catechu there are two varieties—a white and a red kind; but the cutch, or catechu is almost always prepared from the red kind, the white being seldom cut down. Cutch, or catechu, is prepared thus: The tree is cut down to about six to twelve inches from the ground, and chopped into small pieces, the smaller branches and bark being rejected. The chopped wood is then taken to the place of manufacture generally under trees in the open air, and placed over a brisk fire in mud jars, called *gharrahs*, filled with about two third of water. This is allowed to boil down, till, with the extracted matter, it forms a liquid of sirupy consistence. The contents of several jars are then poured into a larger jar and again placed over a brisk fire for a period of from two to four hours, and, when sufficiently boiled down, it is poured out over mats covered with ashes of cow dung, and allowed to dry. The wood, when dry, is used for fuel.

Abstract Hypotheses.—I have come to the conclusion, says Prof. Vander Weyde, in a recent discussion with Prof. Walling, an equally learned antagonist, that the true road to progress in the science of physics lies not towards abstract hypotheses of caloric fluids, luminiferous or electric ethers, or forces capable of moving bodies, all having an independent existence in space. The index-hand of modern science points in a very different direction; namely, towards the study of *matter* and *motion of matter*, and nothing else, dropping all metaphysical assumptions of which matter is not the basis.

Amber Beads.—Many of these ornaments sold for genuine amber are mere imitations. Beads sold for clouded amber are often but a mixture of gums, which are soft and also easily amalgamated with fatty matters and become dull and dirty on the surface as well as scratched. The false amber is easily shown. Scrape a small portion of the suspected material to powder, and if it dissolves in turpentine, whether hot or cold, it is not amber. Real amber has a smooth, clean feel, and does not scratch readily. Putty powder will restore the polish to real amber.

Dr. R. J. Gatling, the inventor of the celebrated Gatling gun, left for Europe on Saturday, the 6th inst., in the steamer *Italy*.

[For the Scientific American.]

THE MIGRATORY LOCUSTS AND THEIR AMERICAN COUSINS.

[By Edward C.H. Day, of the School of Mines, Columbia Colleg].

If the reader will compare the representation of the locust here given with that of the grasshopper in our last number, he will notice, first, that while the antennæ of the latter are very long, those of the former are comparatively short; he will observe also that the female locust wants the sword or saber-shaped ovipositor, and that the male has not the clear spaces at the base of the wing covers that indicate the musical organs of the katydids. He will also discover that the hinder wings have the nervures radiating from the base of the fan-like expanse much more strongly defined—these stiff nervures acting as ribs, and thus affording a firmer support to the membrane, give the locust that power of sustained flight which is the real secret of its existence, in the destructive numbers in which it occurs. This is its advantage in the struggle for existence. The grasshopper, with its weak wings, is limited in its range for food, and the numerical development of its kind is thereby correspondingly restricted; but, as the evidence of Dr. Sinccum shows, with the locust the case is different. That writer tells us of the *Caloptenus spretus*, a species that ranges from the Mississippi to the Pacific, and from the Saskatchewan to Texas, that in Texas "the young were hatched from the egg in the early days of March; by the middle of the month they had destroyed half the vegetation, although the insects were wingless and not larger than a house fly."

It seems evident that had not the most forward of such a host the means, on arriving at maturity, of removing themselves to pastures new, they would speedily eat themselves and their less developed brethren literally out of house and home, and, we may add, their race out of existence. In fact, we presume that vast numbers of them must perish of starvation in their infancy, yet countless multitudes are left to fly off to other regions often very remote; a migration that still leaves enough to propagate the evil in the original locality. And the power of flight possessed by these insects is really remarkable; there are numerous instances, undoubtedly authentic, of their having been met with at sea several hundred miles from land, and, giving currents of air all the credit we can for aid and assistance, yet we must still be surprised at the time such small creatures are able to sustain themselves on the wing.

"If the locusts want the musical apparatus of the grasshoppers, they are not the less," says Professor Blanchard, "good musicians." The difference is, that while the latter perform on instruments *sui generis*, the former are undoubtedly fiddlers; to quote Harris, whose account is at once so full and clear that there is no improving on it, "their hind legs being the bows, and the projecting veins of their wing-covers the strings. But besides these they have on each side of the body in the first segment of the abdomen, just above and a little behind the thighs, a deep cavity closed by a thin piece of skin stretched tightly across it. These probably act in some measure to increase the reverberation of the sound like the cavity of a violin. When a locust begins to play, he bends the shank of one hind leg beneath the thigh, where it is lodged in a furrow designed to receive it, and then draws the leg briskly up and down several times against the projecting lateral edge and veins of the wing cover."

But he has a pair of these violins, so Harris adds: "He does not play both fiddles together, but alternately, for a little time, first upon one and then on the other, standing meanwhile upon the four anterior legs, and the hind leg not otherwise employed."

We have said that the female locust wants the elongated ovipositor of the grasshopper; she has, however, a smaller piece of mechanism by which she is enabled to open a hole in the ground, and into this aperture she gradually inserts her abdomen, depositing her eggs in little tubular cases, consolidated from a sticky secretion. These little cases are represented on the ground behind the female locust in the accompanying cut.

Of the ravages of the locusts, bringing famine and pestilence in their train and causing the death of human beings by the thousand, and it is even said the million, at a single visitation, we have not room at present to select even a few examples. The statements of antiquity have been corroborated by the sad experience of modern times, and the worst species of the Old World are represented by closely allied forms in the New, where we have probably yet to learn the full amount of evil that a wide-spread locust year may do to our rapidly increasing and vital expanse of cultivation.

The most mischievous locusts are divisible into two great genera. The one called *Acridium* (now cut up into several subdivisions) includes the *A. peregrinum*, figured herewith, one of the "migratory" locusts of the Old World and the common red-legged locust of our Eastern States as well as the *Caloptenus spretus* spoken of above. These have on th under side of the thorax a "blunt spine or tubercle," which is absent in the second genus *Œdipoda*. The latter is represented among others by the large Carolina locust that swarms around us at this season, in every walk we take—its dusky wings edged with pale yellow bringing it prominently under notice, and here also belongs the most terrible of the locusts of the Old World, *Œ. migratoria* or the true migratory locust.

Perhaps some of our readers may be prompted to examine the structure of one of these by no means uninteresting insects; if he catches one for the purpose, he will find that the captive resents the seizure by "spitting" upon him. What the nature of this discharge may be we do not know, but it does look amazingly like tobacco juice! The locust "spits" as well as "chews," but it chews the green, clean leaf, and not—well, we won't explain this time, and it spits only in fear and probably self-defense. We never saw one that did chance to fly in at the window desecrate, without provocation, a Brussels carpet or a clean floor, nor if one (quite unintentionally you may be very sure) dropped into a street car, would it celebrate its advent on a lady's dress by expectorating thereupon, that is, if sensibly let alone. We respectfully beg to offer this polite example of a despised insect to all whom it may concern.

METAMORPHOSES OF THE MIGRATORY LOCUST.

[From the New York Daily Times.]

THE SCIENCE OF GOING TO WAR---HOW PRUSSIA IS SUPERIOR TO FRANCE.

It is scarcely possible to over-estimate the advantage which the Prussians have gained within the last fortnight. They have destroyed the confidence of the French in their generals, and are now pursuing defeated and drooping armies with an elated and overwhelming force. Only very enthusiastic Frenchmen can suppose that the Emperor Napoleon is retiring for tactical purposes. If he could not cover Paris at Metz, he stands far less chance of being able to do so at Chalons. Every inch of ground which he is obliged to give up to the Prussians is an immense advantage to them, and a great loss to him. It is the side which is pursuing an offensive campaign that stands the best chance of winning in the end. When this month opened, Napoleon seemed to have this element of success in his favor. In six days he lost it, and ever since then he has constantly been obliged to recede before the irresistible pressure of the Prussian hosts. That he is out-numbered, we have no doubt. But how will he justify himself before the French people for entering upon a war for which he was so fatally unprepared?

The superiority which the Prussians have thus far shown, they seem likely to retain until the close of the war. Some people appear to suppose that the disproportion in numbers between the Prussian and French armies will disappear as the campaign goes on. We believe, on the contrary, that it will remain very much as it is now—or that if any change be made, it will be in favor of the Prussians. They have a more efficient system of keeping their forces at a given level than the French. As soon as the mobilization of the Prussian armies takes place, depots of reserve are formed all over the country. Supplies of men and horses are dispatched from these depots to the front on the first day of every month, the number being calculated on an accurate estimate, based upon carefully prepared statistics. The soldiers thus constantly gathered in to make up losses in the field are one half called up from the Landwehr—men who have already served, and know their duties—while the other half are recruits. They leave the depots provided with everything they need, so that they are ready for service the moment they reach the front. This is the system which has called forth the enthusiastic praises of every foreign observer who has carefully studied the organization of the Prussian army. Levies of raw recruits cannot cope with a force raised in this scientific manner.

There are the French fortresses, it is true, but they are useless while the French armies are held in check. It seemed impossible, a fortnight ago that Prussia would be able to isolate Metz without an effort. Yet that is what she seems to be doing now. She can afford to detach from her main armies a force sufficient to give employment to the French troops in Metz. The invading force can thus march on, and the army inside Metz could neither follow it nor cut off its retreat if worsted in open engagements. This is the experience of Prussia in the Austrian campaign. She had then smaller fortresses to deal with than she has now, but, on the other hand, she has larger armies at her disposal. "Josephstadt and Königgrätz," says Capt. Hozier, "did not delay the Prussian armies for a day, though they are both strong places, and would possibly have stood a long siege; but they were both masked by detachments, the loss of which from the line of battle was hardly felt by the main body, and though no trenches were opened, and no guns mounted against them, the great line of the Prussian communications passed in safety within a few miles of their paralyzed garrisons." This operation, on a larger scale, the Prussian commanders are now adopting in dealing with Metz. For this, as for everything else, Napoleon seems to be "unprepared." But that explanation will not soothe France under the disastrous blows which are being inflicted upon her.

The Prussian losses are filled up as fast as they occur. The French seem to be under the impression that the forces they first sent into the field would be amply sufficient to finish the war. It was only under the surprise and alarm of the first great reverse that they began to talk of "filling up the void" in the army. Within a month after the Prussian army marched to the field, the first supply of men from the depot reserves was forwarded to the front. There was no waiting for telegrams or orders. The reserves are forwarded at stated intervals, whether they are wanted or not. The French armies have not only been weakened by heavy losses, but further depleted by the necessity of detaching large forces for the defense of Strasbourg, Metz, and other places. Again, the French commissariat system seems to have completely broken down, just as the English system did in the Crimea—when the only breakfast served out to men who had spent a bitter winter's night on the bleak hill sides was green, unroasted coffee. Now the Prussian commissariat cannot fail in this way. It would take too long to describe the method upon which it is organized—but, as was proved in 1866, its success is assured from the first moment of the war to the last.

These are some of the points in which the Prussians have an advantage over the French. They help to explain the many discomfitures already sustained by the French; and incidentally they show how absurd was the sympathy lately expressed for "poor Prussia," because Napoleon had taken her "by surprise." A nation in which every able bodied man, except clergymen, is obliged to serve in the army, and which has the finest military organization the world has ever seen, cannot very well be taken by surprise. Count Bismarck, while no doubt very thankful for the good wishes which greet him and his cause from this country, must have been not a little amused with the idea that Napoleon had outwitted him, and had forced war upon a country intent only upon the arts of peace.

MACHINISTS' TOOLS.—L. W. Pond, whose advertisement of machinists' tools appears in another column, writes to us as follows: "My works are now fully occupied in the manufacture of my improved tools and machinery, and many concerns contemplate refitting entirely with them, as has in some instances been done already, with great gain in production. The activity now prevailing at my works *is very largely due to my little card in the advertising columns of your widely circulated journal*, which I propose to continue indefinitely.

Correspondence.

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

Racing Boats.

MESSRS. EDITORS :—To one who has never pulled an oar in a modern shell there is yet to be experienced a thrilling and exhilarating sport, never experienced when using heavy oars (weighing as much as three shell spoons) ; nor when the boat moves slow, preventing an energetic stroke, so characteristic of shell boats; nor when the position of the body, high above the water, places the oar at a bad angle with the water to get a fair pull.

To a great many young men, and lady readers, let me give a few words, and particularly to those living near a river or lake, or within a drive of one. When the writer first took up his residence on the banks of the Passaic, boating there was dormant. I had never been able to enjoy such opportunities for rowing before, and my enthusiasm was kindled by the reports of shell sports on the Hudson. I had the enthusiasm, but not the greenbacks to get the shells. To those who may have the same affliction, and also to those who may be afflicted with want of enthusiasm, but having means, it may be worth stating that it is possible for most ingenious persons to make their own shell boat, and to this end I offer my experience.

I procured two pieces of pine, ¼ inch thick, by 3 inches wide, which, when joined in the middle, made a keel just 30 feet in length, Fig. 1. This I set upon its edge, and rounded it on the bottom, Fig. 2, to fit the skin, or outside of the boat. From a piece of siding (or clap-board) I made the braces, Fig 3, of a width about 14 inches in the widest part, and tapering both ways, until no brace was required. Two braces were made different from those, of one inch thick, and of pine, see Fig. 4. The one nearest the bow, I placed 18 inches from the middle of the boat, the other about 30 inches. The depth of the boat and of these braces was about 5 inches, except that at the ends of the boat, when they can taper down to 3 inches. The two braces, Fig. 4, measuring from A to B, five inches ; but from A up to C, 6 inches, or the width of a clap-board.

To make the skin of the boat I got a *basswood* plank (Spanish cedar was *the* wood, but economy was my aim). This plank was sawed and planed as thin as possible, like bandbox stuff. This I cut in lengths, so as to make the seams on the bottom. Break joints, from D to E, Fig. 5, two full lengths on both sides ; then piece the ends. This stuff I soaked about an hour, before putting on. I used brass screws, and putting them in bent the stuff over the braces. In doing this, one should be sure that the keel rests on a good level bed, and is held by a piece, Fig. 6, nailed to the floor, or bed, the boat being upside down, and the keel fitting into this piece.

On the ends, over the basswood covering, fit a brass plate, to prevent breaking at the points. Cover the seams on the bottom of the boat, from "stem to stern" with a thin plate of brass (stencil plate stuff), using copper tacks to fasten it.

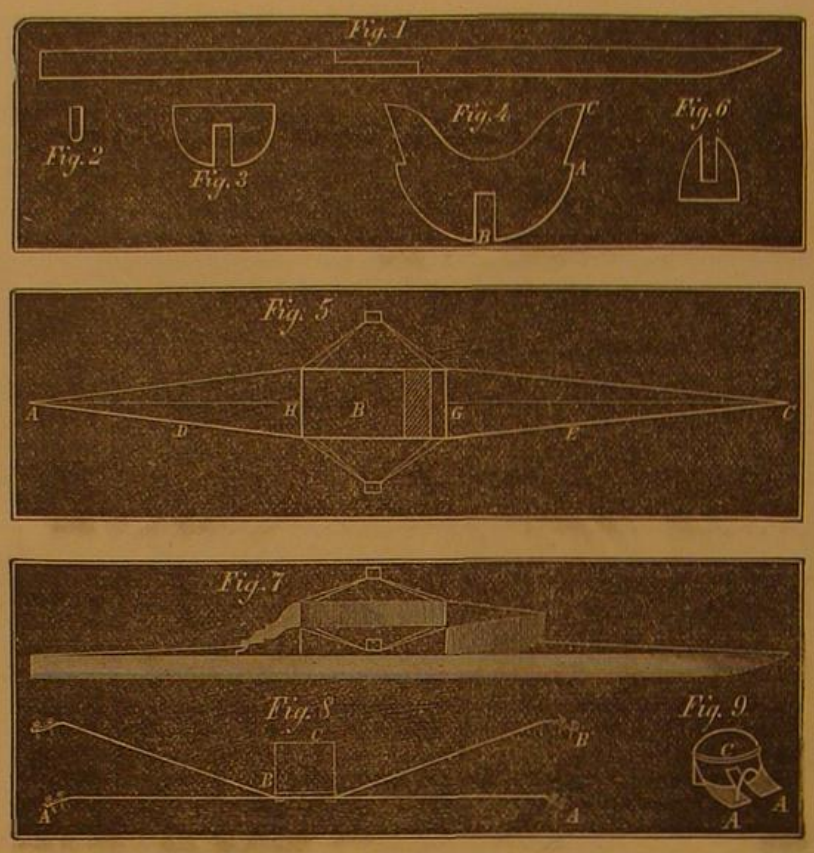
The boat is now complete except the top, the cock pit, seat, oar locks or outriggers, and spoons. On the top of the braces, all around the boat, fasten a thin strip, like a lath, and on braces, Fig. 4. let this strip fit into on the shoulder, A. Then put on like strips edgewise, from G to H, Fig. 5, to the ends of the boat, cover the whole of the top, with cloth (silicia, or or dress lining) tacking it to these strips. Cover the tack heads with a small bead. Now the boat is entirely closed in, except where the rower is to be seated. Let the seat be fastened to the keel.

The cock-pit is made by fitting the clapboards (or siding) around the braces, Fig. 4. At the end towards the bow fit two pieces to run out about two feet before meeting like a V, and at the stern let the pieces be formed in a graceful scroll. The irons, or outriggers, are 4 feet 6 inches apart, across the boat ; and at their outsides, at bottom, about 14 inches from the water. The irons are made as shown in Fig. 8.

Another little attachment is a foot-board, the bottom of the boat being so thin that the feet must not rest on it. This is shown in Fig. 9. It is like a brace, to fit over the keel, with two pieces of sheet-iron (A A) for the heels to rest upon ; C being a strap to pass over the instep, so that, in rowing, when the body goes back to get a full stroke, the feet help to bring into use nearly, if not quite, every muscle of the body. A pair of oars, or spoons, can be bought for about $9. Paint the boat a cedar color ; top, a light drab. When you are ready to take a row, take off your watch, valuables, and other unnecessary weight, put on clothing that will not hurt by being wet, and seat yourself carefully ; pull evenly, and this little craft, just as wide as your hips, and fifteen feet both sides of you, will fairly glide from under you. Do not look at the passing water at your elbow, but away back, and you will soon be able to row a mile, as I have done, in nine minutes.

Do not be afraid of getting wet when commencing, and you will probably not get a wetting. I have not tipped over yet, and if a person keeps cool, there is no liability to do so, for when the spoons are in your hands, you have complete control, and the tipping is of no consequence, unless you break something, then you are over as sure as a bird in the air with only one wing. I call my boat the *Home-made*, and it cost me, without the spoons, less than $20. N. F. P.

Paterson, N. J.



Thunderbolts and Lightning Rods.

MESSRS. EDITORS :—On Tuesday night, Aug. 9th, 1870, the weather being warm and sultry, with a display of silent lightning in the north, from early night up to the occurrence of a violent storm, described below, the barometer standing at 29·7°, thermometer at 85°, the air very humid, causing languor and depression of the nervous system, I determined to devote the night to the study and observation of the elements over head.

The humid air seemed to be conducting the surplus caloric of the earth, that it had imbibed through the feverishly heated day, up into the region of clouds, causing its fiery wings to flap as it labored up through the quasi-conducting medium.

At midnight the clouds began to thicken over head, and two thunder clouds, one from the N. W., and another from the S. W., were evidently forming a conjunction immediately over the city. There was very little wind below. The clouds were running low and had a peculiar dingy appearance, which in connection with the enervating sensation before mentioned, predisposed me to anticipate shocks of a coming earthquake. Soon, however, the heavens above developed a terrific display of electrical pyrotechnics. Flashing and crashing followed in quick succession. I was standing at the second-story window, and the heavens seemed literally on fire. The air was filled with ozone, perceptible to smell and taste. The trees and houses around were illuminated with a pale, lambent flame, and, suddenly, an explosion came that shook the earth. The windows of the house rattled, and things delicately poised toppled over. The pyrotechnic display for half an hour was grand beyond description. Several persons in the neighborhood screamed in terror as an explosion, within two hundred yards of us, took place. Of nineteen different persons that I conversed with that felt its effects, three aver that they were tumbled from their beds ; several complained of being severely shocked ; some of being benumbed ; and most of being slightly shocked, some in the head, and some in the articulations of the joints.

About one o'clock the storm had passed so far to the east as only to be heard and seen in the distance. In the mean time the city had become aroused by the cry of fire, the ringing of church bells, and the rumbling and piping of steam fire engines. It was a night long to be remembered by the people of Lancaster ; some asserting that they believed the Judgment day had surely come.

The following morning, in company with several gentlemen of our city, I made a tour of investigation in person, to see and learn how the question concerning thunderbolts and lightning-rods stood, for never before did this matter present itself so full and fair, and within my personal reach, for investigation. It summed up thus :

No. 1. Mrs. Kelly's house, corner of Orange and Shippen sts., standing on the highest ridge of the city, and provided with an iron lightning-rod, was struck on the rod, slightly bending and pressing the point. The large boards of the gable, running up within two feet of the rod, were set on fire and ignited the wooden structure of the roof between the slating without and the plastering within, permeating the whole surface of the roof and destroying it. The fire engines soon arrived and saved the main building, after flooding it it with water. The cellar wall of the building, corresponding to the line of the rod under ground, was shattered, and the mortar was driven out between the stones. The copper bell wire, running along the ceiling and middle of the cellar, was totally deflagrated, leaving a corresponding line of smoke in its train, up to the ceiling in the story above, and to the bell. The bell, and spiral spring fastening it to the wall, were intact, but the wall was perforated, and the plaster displaced, and, in the chamber over this, the washboard was punched away from the wall. The house contained a number of persons, but none were hurt, although near neighbors declare they were shocked and moved from their positions.

No. 2. Mr. Henry Doerr's house, in Water st., was struck. This was provided with a lightning-rod on its gable end, running up to, and some distance along the apex of the roof, jutting up two points six or seven feet in hight. The point nearest the gable end was slightly bent and fused, and the roof was fired at the edge where the rod turned over, and where it was insulated with glass. From this point the fiery bolt drove into and on the attic floor, igniting it and charring a surface the size of a hat crown, and a depth of a quarter inch. Mr. Doerr, smelling the ozone and fire, hurried up with several pails of water and put it out. This rod was a wire rope and set in glass insulators from end to end. Mr. McGinnes, the next door neighbor, who was, at the time, fixing his rain-water cask, had his hand singed and received a shock.

No. 3. The house of Mr. Thomas Silvius, situated on the lowest ground in the city, and on a little stream of water, close to the gas works, was struck, not on its highest point, nor on any point, but at the top of the valley formed by the cave of the main building and the top of the back building. The lightning tore up a few shingles, ran from thence down the valley of the conjoined roofs to the water trough, where it encountered a tin fender, placed there to keep the rain water from dashing over the trough, burned a hole an inch in diameter through it, passed thence along the trough to the pipe, and down the pipe, burning holes half an inch in diameter at each overlapping joint, splintering the edge of the rain cask, and exhausting its fury in the water. This house had no rod.

No. 4. The house of Dr. J. P. McCaskey, in Walnut, near Duke st., was struck on the kitchen chimney, the top bricks of which were knocked off, the fluid then passing down the the chimney and displacing a sheet of iron over the fireplace, and another portion taking the course of the stove-pipe, forcing open the stove doors, but doing no further damage. This house had no rod. Several houses within a hundred feet had rods, but were not affected.

No. 5. Mr. Eshback's house, at the North end of Duke st., was struck on the chimney, with no further damage than the displacement of a few bricks. This house had no rod.

No. 6. The Pennsylvania Central R. R. Co.'s telegraph office, in the depot, had its office-connecting wires burned out, and a chair standing near hurled across the floor.

In all this we have the evidence that buildings are struck indiscriminately, rod or no rod. The two buildings that had rods on them were the only ones that were fired, and it might be inferred that they received the heaviest bolts, but this is not the case. Nos. 4 and 5 were apparently slight. No. 3, that of Mr. Silvius, he describes as most terrific. Two of his daughters, having thrown their bed on the floor, and near the wall, were severely shocked, and the one nearest the wall for a while benumbed. Mr. Silvius was reclining, with his head on the window sill, under the water trough of the back building, and received a concussion on the top of his head that made him think for the moment he must die ; and, to use his own words, "When I opened my eyes, the fire was raining down through the grape vines." This was an optical delusion. I experienced the same impression in the explosion that fired the Kelly house, being within two hundred yards of it. It is the vivid impression of the electric fire lingering on the retina of the eye.

Now comes up the query, why were the houses with rods on them fired, and those without not ? If it were the reverse, the rods would be entitled to some credit ; but, in this instance, they have acted the part of incendiaries. Like the needle in the celebrated Prussian and Chassepot guns, the rods conducted the electrical fulminate into the combustibles. And in my fifteen years' observation of them, they have distinguished themselves in that peculiar characteristic.

Lancaster, Pa. JNO. WISE.

Cause of Thunder.

MESSRS. EDITORS :—I recently saw an article in your paper entitled "Theory of Thunder." That is the decomposition of water by lightning, and the reunion of the gases, causing thunder. I am of the same opinion. In proof that it is so, I have often heard the sharp crack of the electric spark, immediately followed by the crashing roll of thunder, that is, when it strikes a rock or some blunt substance. The detonation of the spark is much louder than a rifle. Neither do I think that the crack of the electric spark is owing to the sudden collapsing of the air, but to the sudden expansion or contraction (as in the cracking of rocks, glass, and other brittle, partial non-conducting substances) or re-arrangement of the atoms of the bodies from which and to which it passes.

I have heard of cases of boilers being blown from their settings in a mysterious manner. I have known the gases generated from a smoldering fire in a blacksmiths' forge, when suddenly fanned so as to make a blaze, to explode, violently throwing the coal from the forge. By throwing a little water on the fire, and fanning gently and then strongly, so as to bring a blaze, I can almost always get an explosion.

Stoves, when filled too full, have been known to explode, tearing chimney and stoves to pieces. Why should not this be the cause of boilers being blown from their settings ? The dripping of water from a leaky boiler causes the smoldering fire, from which carbureted hydrogen is distilled, which rises and mixes with unconsumed oxygen from the draft, forming a mixture which requires but the temperature of a blaze to explode.

Boston, Mass. FLETCHER SYMMS.

Speed of Circular Saws and Saw Mills.

MESSRS. EDITORS:—Under the above heading, on page 51, current volume, appears an article from C. H. Crane, stating the amount of lumber cut with a circular saw 66 inches in diameter, running 800 revolutions per minute. As I am filing a circular saw in Messrs. Holt & Balcom's mill, in this city, I thought I would send you the amount of lumber cut in this mill the last week in July, sawing six days and six nights, the mill inside being in charge of Mr. Nicholas Emery.

I will give a short description of the mill, which has one stock gang, 26 saws, 24-in. stroke, one slabbing gang, sixteen saws, 28-in. stroke, one large circular saw, one splitting saw, one gang edger with four saws, and one single edger behind the circular. There are five boilers, 42 in. diameter, 22 ft. long, two 16-in. flues in each. Engine, 24-in. cylinder, 32-in. stroke, runs 70 revolutions per minute. All the saws are driven by friction pulleys, belts running from counter-shafts to saw arbors of edger saws, etc. Each gang has a driving pulley on main shaft of wood 10½ ft. diameter, 30 in. face, the driver pulleys on gang crank shafts are of iron 4 ft. diameter, and 30-in. face, making the gangs run over 180 revolutions per minute.

The circular has a driving pulley of wood 11 ft. in diameter, 30-in. face, and two counter shafts, one front and one back of main pulley, with an iron pulley on each, 4 ft. diameter, 30-in. face, making a double friction on a belt connecting the two counter-shafts. The large belt pulley on counter-shaft is 9 ft. diameter, and pulley on saw arbor, 30 in. diameter, which would make the saw run 693 revolutions per minute, has a 14-in. double belt.

The circular machine was built by Stearns, Clark & Co., at Erie, Pa. The saw arbor is 4 in. diameter, and saw collars 5 in. diameter. The saws are 60 in. diameter, No. 5 gage in center of saw, and No. 8 gage on rim, and made by the American Saw Co., Trenton, N. J., with Emerson's patent movable teeth.

The feed we carry with these saws is from 1 to 5½ in., according to the nature of the wood that it is cutting—our feed averages over 4½ inches to one turn of the saw. I have seen them cut 6 inches to one turn.

Each large saw has 32 teeth. There is an overhead saw, 34 in. diameter. They will cut 7 boards, 16 ft. long, per minute, or 6 boards 18 in. wide, or 4 boards, 24 inches wide, and 16 ft. long, per minute. I have seen them saw a log, making 20 cuts, 16 ft. long, and turn the log 4 times on the carriage in 3 minutes, all strips 1 in. thick and 6 in. wide. The logs that were sawed during the week were not picked logs, but taken out of the boom as they come, running from 12 in. to 40 in. diameter.

By the following table, which was taken from the tally-board for the week, will be seen the number of logs that was sawed on the gangs, and also those saw on circular, and the number of feet they measured:

	No. of logs.	Gangs—night.	No. of logs.	Circular—day.	No. of logs.	Gangs—night.	o. of logs.	Circular—night.	Total No. feet.
Mon.....	245	70,621	152	35,743	241	63,578	117	30,959	199,902
Tues.....	225	71,318	154	38,071	217	62,959	91	22,956	195,304
Wed.....	222	70,882	165	39,098	233	69,120	133	31,690	209,790
Th.....	244	80,210	157	37,970	237	75,213	141	32,599	225,905
Frid.....	256	80,571	162	40,146	257	73,335	139	32,857	225,029
Sat.....	257	81,321	141	40,860	261	77,999	113	30,128	230,248
									1,286,178

There were 4,538 logs cut; over three fourths being 16 ft., rest being 12 and 14 ft. long. Between 6,000 and 7,000 of 2 by 6 were saved on the circular, all the rest were what we call strips, 1 in. thick, and 6 in. wide. There were 150,000 laths cut in the same time with one bolting, and one lath saw only running in the day time.

The day hour commences at 6 A.M., and ends at 6 P.M., ½ hour for dinner leaves 11½ hours. Night tour from 6:30 P.M. to 5:30 A.M., ½ hour at midnight for supper, leaving 10½ hours. The circular lost 3¾ hours' time in all on Monday, Tuesday, and Thursday nights. Gangs lost about two hours' time.

I leave it for the readers of the SCIENTIFIC AMERICAN to say if this equals the sawing done by C. H. Crane.

We could cut 50,000 feet stuff the same dimensions as that which C. H. Crane sawed in the same time with this circular.

Oconto, Wis. LUKE BALCOM.

Poison Oak.

MESSRS. EDITORS:—I notice in your issue of the 13th, an article from a writer in the *Entomologist*, who was suffering from the effects of a vine commonly known as poison ivy. The poison ivy of this country is entirely different in appearance from the poison oak common to the Pacific coast.

The poison oak grows there in the form of a small oak bush, often attaining a hight of four or five feet, and in some cases, has long, slender, vine-like branches. Its poison is much stronger than that of ivy, and will yield to no treatment that I am aware of but iodide of potassa. In the *very* worst cases of poison oak it gives immediate relief, as I have witnessed and experienced.

Any physician or druggist can put up a prescription in proper quantities.

Newark, N. J. ANSON SEARLS.

Moon Fallacy.

MESSRS. EDITORS:—I have seen several articles in your paper in regard to cutting timber by "moon signs." More than forty years ago, I cut, for a number of years, at different times in the year, considerable second-growth white beech for plane stocks, which I think is the worst wood known to preserve sound (or keep from getting "dozy," as we used to call it). After trying many moony experiments, summer and winter, I came to this conclusion, that the true secret was to cut th timber when there was the least possible amount of sap in the body of the tree—say the coldest weather in the winter or the warmest in summer—June or February, when the sap is in the tops or in the roots of the tree. Every tree I cut after the sap began to start in the spring was sure to "doze," until June, when I found it safe to cut again.

G. W. HILDRETH.

Lockport, N. Y.

To Prevent Cracking of Wagon Hubs in Seasoning.

MESSRS. EDITORS:—In answer to your correspondent E. H. H., of Md., who finds difficulty in the cracking of wagon hubs made from "black gum," I have to say that from satisfactory investigations made with the vapor of coal-tar wagon hubs and stock can be perfectly insured against cracking, shrinking, and swelling, in any climate.

The apparatus is very simple. Take a common "try pot," such as is used by whalers, or a farmer's large boiling kettle; fit to it a wooden cover, to fasten with small screw bolts or clamps to the rim to be vapor tight. A piece of one-inch gas pipe screwed into the cover serves to convey the vapor of the coal tar from this extemporized still to a large cask, which may be set upon one head, as a receptacle for the hubs. The still pipe is led to the bottom of the cask, which is then filled with hubs, and a cover fitted over all, to be vapor tight, with a small safety valve arrangement to regulate the pressure. The kettle is then filled with refuse matter from the gas works or crude coal tar, the cover secured, a fire lighted under the kettle, and shortly the hot lighter vapors penetrate the mass of hubs at a temperature of about 200° to 220° Fah. The hubs are effectually and gradually heated, so that all the watery particles are expelled from the wood in steam and replaced by the light vapors of the hydrocarbon oil. Subsequently the heavier oils are distilled over and fill the pores of the wood. The process is finished in about twelve hours, and you have a hub that will stand anywhere short of a fire. A few experiments will satisfy any one of the efficacy of this treatment. One of the products of this distillation is carbolic acid—the best known antiseptic—and the hubs will be found strongly impregnated with the peculiar smell of this well-known agent.

A large establishment would of course have a more perfect apparatus, but the above will serve to prove its value at small cost.

PACIFIC.

San Francisco, Cal.

Seasoning Hubs.

MESSRS. EDITORS:—If E. H. H., of Md., will bore his hubs immediately after they are turned, and paint (as soon as possible after turning) the entire outside with any kind of paint which will effectually prevent the moisture escaping through the outside surface, then give them time to season, the moisture in the process of seasoning will escape through the aperture bored to receive the axle while the surface will be held intact. When well seasoned, mortice for the spokes and drive them in immediately; by doing so he will avoid the cracking of which he complains.

A. GREGG, M. D.

Indianapolis, Ind.

Worms and Insects.

MESSRS. EDITORS:—I have been much pleased and instructed by the able articles appearing in your columns, on various characters of insect life, by Prof. Day, of Columbia College. Some of us, less learned in the homes and lives of the bugs and worms, would be glad to have him tell whence comes and whither goes the new and intensely disgusting worm which has, within a few years back, begun to attack the ailanthus trees.

H. E. C.

Brooklyn, N. Y.

[These worms are those commonly called the ailanthus silk worm. They were, we believe, brought from France here by somebody as an experiment. Residents of Brooklyn no doubt wish the experiment had never been tried.—EDS.

[For the Scientific American.]

THE TRUE THEORY OF FLYING.

The world seems to have concluded that the cycle of inventions is complete—that the telegraph has taken the last and topmost place; and that men must be satisfied with the great time and labor saved which they now possess.

But the Duke of Argyle, and a few other brave spirits, think differently, and are spending time and money in endeavoring to obtain for us the art of flying, which has so long bid defiance to human skill.

The writer has been deeply interested in the subject, and perhaps his conclusions may be of service to those who are experimenting upon the art. They are as follows:

1st. No successful flying machine can be constructed, which depends for its support in the air, upon the balloon principle—that is, which requires a bag full of gas for its flotation in the atmosphere. Because, the surface of resistance increases as rapidly as the propelling power is increased—greater weight of engine, etc., requiring greater size of balloon for its support in air. Because this plan has been tried both in New York and San Francisco without a shadow of success. Because it is in direct contravention of the method of nature. Every bird weighs so many pounds or ounces avoirdupois, and the heavier the bird, as a general rule, the more powerful and swift the flight.

2d. The future flying machine must be constructed upon some mechanical principles analogous to those which obtain in nature. Looking at these we find two prime requisites: 1st. A mechanical contrivance adapted to supporting and propelling the flying creature. 2d. A tremendous muscular power to call this machine into action. It would not be difficult to imitate the wings of a bird, with sufficient observance of the laws of mechanics to fulfill the conditions of ascent and propulsion, provided that we could get the power to drive our machine.

A system of properly-balanced and adjustable vanes, inclined on the principle of the propeller-screw will raise a flying vessel in air, and propel her in any direction. But the driving power must be enormous in proportion to the weight of machinery—just as the pectoral muscles of the bird are far more powerful than those of any non-flying animal; or, as far as I am informed, than any other muscles whatever, in proportion to their weight.

The whole question is then—What can we find analogous to the driving power of the wings of a bird? What power is there in nature which we can lay hold on and turn to our uses, which, nevertheless, needs no cumbersome boiler, no heavy fuel, and no complicated, and therefore weighty machinery—all and each of which are death to the flying machine theory.

Let us look at the known agents which we employ in propelling our machines.

There is steam. It requires no argument to show that its power is inadequate to carrying the necessary weight of machinery, etc., in air. Electricity is probably weaker than steam, under these conditions, in its present mode of use.

Either the power required must be concentrated before starting, and deposited in the machine in the shape of a compressed spring, or a cylinder full of condensed air, or we must get some new agent, as yet untried, which will give tremendous power without weight in as great proportion as in the known engine.

The compressed spring or condensed air plan may do for short flights. The writer however, has not much faith in either, and has not the present ability to test them by experiments.

But we have an agent sufficiently powerful and perhaps sufficiently governable, which will drive our flying machine for us with abundant force. Either gunpowder, dynamite, or the fulminates, have sufficient strength, with comparatively no weight. Witness the flight of a five-hundred pound shell for miles, at an elevation of thousands of feet, driven by a few pounds of powder! Consider the number of horse-powers involved in this exhibition of strength, and calculate the weight of the steam engine, its boilers, and fuel, which should accomplish such a result! There is no question about our having the power, but have we not too much? More than is controllable by human ingenuity?

The flying machine of the future does not need to draw upon these terrible forces to their full extent. Gunpowder and all explosives have limits to their power and are governed by laws, and can probably be used as propelling agents with a safety greater than that of the steam engine.

They are the only known agents which are, in their great power and small weight, analogous to the muscles of the bird.

How this power is to be applied and regulated could soon be ascertained by ingenious and educated engineers. Perhaps it would be well to have a cylinder in which successive explosions should preserve a constant and high pressure, which, by proper machinery, would drive the propelling fans.

Or, if a fulminate is obtainable which condenses to an insignificant amount of liquid immediately after explosion, a pair of iron hinges, as it were, which would expand and contract with great force by these successive explosions and condensations, might furnish the desired means of applying the power.

The rocket is a proof of the power of powder to carry vessels through the air. It is the rudest form of flying machine, and when the genius of man is fully directed to economizing and guiding the great power which is the cause of the rocket's flight, we will have a speedy, practical, and safe flying vehicle which will astonish the world by its simplicity and tardy discovery.

A few misconceptions on the subject may be spoken of. It is generally supposed that a flying machine must be a perilous means of travel. This is not so. If one were constructed on the principle spoken of in this paper, there would be no necessity of its travelling high in the air. A few feet above the ground would suffice, and many known appliances could be added, which would render a fall innocuous. The lower side could be arranged with powerful spiral springs, which would make a concussion harmless, or a system of parachutes could be devised by which passengers could descend to the ground with safety.

Arguing from the analogues of nature, as we find that the largest fish far exceed in size the largest bird, so science will find itself compelled by laws, at present unknown, to limit the size of flying machines to some such ratio with steamers, as obtains between bird and fish. If the largest bird is only one-tenth the length and general dimensions (not meaning bulk) of the largest fish, so, considering the largest steamers to be 500 feet in length, which they will probably not successfully exceed, we can expect flying machines, perhaps fifty feet in length. As the speed of the bird is swifter than that of the fish, so we can look for a greater speed in air, by the same rules, than in water. The flying machine in future will go to Europe in two days, and with greater safety and comfort than the present mode of transit.

They will be swifter, easy of construction, and will come into universal use, though they will be more expensive than other conveyances. Speed and concentrated fuel *mean* expense. As rapidly as the magnetic telegraph, when once invented, overspread the globe, so rapidly will every county and town adopt the new invention of the new future, the *hoplites* of traveling convenience.

C.

HE who strikes out a new path in art, science, or literature, secures for himself persecution.

DIAMOND CUTTING IN AMSTERDAM.

Our readers will recollect an interesting communication from the pen of Mr. J. E. Emerson, published on page 390, Vol. XX., of the Scientific American, on diamonds and diamond cutting in Amsterdam, Holland, a city famed for this industry, and in which probably more precious stones are cut and polished than in all the rest of the world put together.

Our engravings herewith published illustrate the various processes employed.

Fig. 1.

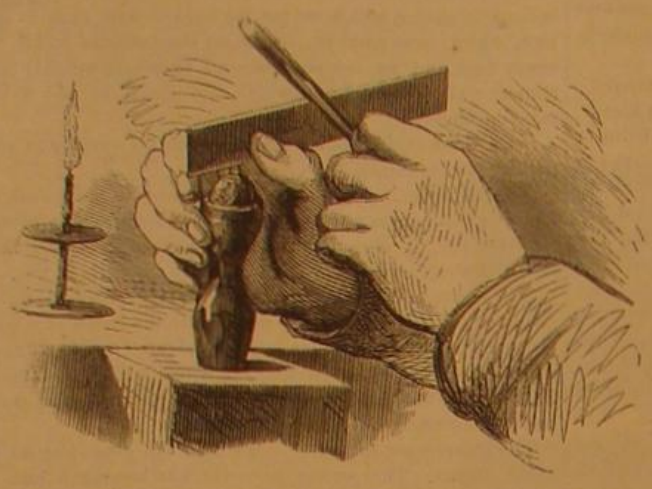


Fig. 2

Fig. 3.

MODE OF CUTTING DIAMONDS.

It must be borne in mind that in the treatment of the most costly substance known to man that only the most refined skill can be tolerated. The lapidaries of Amsterdam are men who undergo a long and severe apprenticeship in the cutting of inferior stones before they are intrusted with valuable gems.

The diamond, like all other crystals, has its lines of cleavage, in which it can be readily split, the process being performed as shown in Fig. 1.

The stone is first examined to determine whether it possesses any flaws or defects, the presence or absence of which will determine the character of the subsequent work. Stones are often divided on account of such defects, which otherwise would be worked entire.

The examination is made by either steeping the diamonds in Canada balsam, oil of sassafras, or anise-seed oil, and being turned around in one or other of these fluids, the changed refraction of light renders the flaws apparent; or the stone may be heated and thrown into water, when it cracks to pieces where the flaws exist.

If, on account of defects or from other cause, it be decided to split the diamond, it is furrowed on the proper plane by a sharp-edged diamond, and the cleaving tool applied to it, as shown in Fig. 1, the diamond being held in position by a strong cement, which fastens it to a block of wood. In regard to this operation Feuchtwanger remarks that "it is made a great mystery." The splitting instrument is of steel and it is operated by striking it upon the back, as shown.

Fig. 2 shows the "Dopp," as it is called, a copper cup with a stem of stout copper wire, in which is fixed a ball of plumber's solder. The upper part of this ball is softened by heat, and the diamond is imbedded therein while undergoing the process of polishing, its position being changed as often as required, by fusing the solder.

Previous to the polishing it is cut into the proper form by hand, as shown in Fig. 3. In this operation the diamond is cemented to the end of a stout stick, about a foot long, leaving only such part projecting as will, when removed, leave the desired facet. The instrument employed for cutting is another diamond fixed in a similar stick, and having one of its solid angles projecting. Feuchtwanger says:

"In order to collect the powder and shivers that are detached during the process, the cutting is performed over a strong box, four or five inches square, furnished with a false bottom perforated with excessively minute holes, in order to sift, as it were, the dust from the shivers; and also with two upright iron pegs, fixed on the sides, for the workman to support and steady his fingers against, while with a short repeated stroke, somewhat between scratching and cutting, he is splitting off, or more laboriously wearing away the diamond in that part where the facet is to be placed. This being done, the cement is softened by warming it, and the position of the diamond is changed, in order to bring a fresh part under the action of the cutting diamond. When, in this slow laborious way, all the facets have been placed upon the surface of the diamond, the cutting is completed. The stone, if examined by a moderate magnifier, now presents ragged, rough edges; and a broken, foliated surface, with a glistening luster on those facets that are nearly in the direction of the natural laminæ, and on the other facets a more even surface, but of a dull, opaque, grayish-white color."

The next operation is that of polishing, shown in Fig 4. The diamond being fixed in the dopp, as above described, is held upon the polishing mill, a simple circular cast-iron plate mounted on an upright spindle, as shown, driven by means of a larger wheel and a belt. The large wheel is usually turned by an assistant. The upper surface of the plate is covered with radial lines or scratches formed by rubbing it with a fine-grained stone. These lines aid in holding the polishing material, a mixture of diamond dust and oil (oil of brick). The stem of the dopp is held by pincers or "tongs" of wood, as shown, weighted to give the proper degree of pressure. The "tongs" have two legs at the end remote from the wheel, which rest upon the table, and pegs of iron serve to steady them during the operation. Sometimes three or four diamonds are simultaneously polished. The completion of a single facet often occupies some hours.

The brief description we have thus given will give a general idea of the processes of splitting, cutting, and polishing diamonds, but an adequate idea of the patience and skill required to do the work in a superior manner, is doubtless only to be gained by personal inspection.

Fig. 4

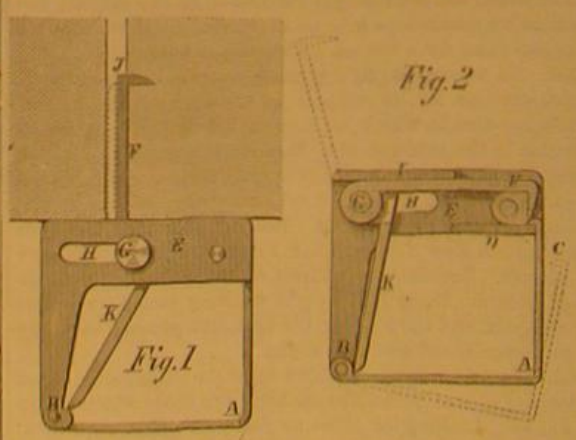
MELENDY'S IMPROVED COMBINED KEY RING AND DOOR FASTENER WITH COMPENSATOR.

Our engravings illustrate one of those simple yet convenient devices which often secure great popularity, while at the same time their parts can be made by machinery at a rapid rate and very cheap, so that they afford a large profit to the manufacturer.

Punching and finishing by polishing comprise nearly all the work on this device, except putting it together.

Fig. 1 shows the device as used for a door fastener, and Fig. 2 shows it as a key ring.

To adjust the parts, as shown in Fig. 1, for a door fastener, the spring bar, A, which is bent at right angles, and pivoted at B, as shown in both figures, and which is provided with a



lip, or catch, C, as shown in the dotted outline, Fig 2, is sprung off from ribs or ledges, D, Fig. 2, formed on the inner sides of the side pieces, E. This allows it to turn on the pivot, B, and drop into the position shown in the dotted outline in Fig. 2.

This being done, the hook, F, which, when in the position shown in Fig. 2, cannot turn on its pivot, G, Figs. 1 and 2, may be thrust along, its pivot sliding on the slots, H, formed in the side pieces, E, till the pivot, G, reaches the end of the slots, H. This releases it from its engagement under ledges, I, also formed on the inner sides of the side pieces, E, and allows it to be opened on its pivot, G, into the position shown in Fig. 1 While in this position, its pivot, G, may be slid along in the slot, H, to its original position. Then the hook, F, being placed between the edge of a door and the jamb, so that the jaw, J, is towards the jamb, closing the door will drive the jaw into the wood. The body of the apparatus being then slipped along on the pivot, G, into the position shown in Fig. 1, it abuts against the door, so that the latter cannot be opened by any one outside, except by tearing out the wood of the jamb.

Should the door have shrunk, so that it does not press sufficiently against the hook, F, to force it into the wood, the compensator, K, also pivoted on G, is turned up to the back of F, as shown by the dotted outline in Fig. 1, so as to fill up the space left by shrinkage.

When the bent spring-arm, A, is opened, as shown in Fig 2, and in the manner above described, keys may be slipped upon it; the arm clasped again will hold them securely.

This device has been made the subject of two patents, dated respectively, May 17, and July 19, 1870, both issued to B. H. Melendy, 36 Walnut Street, Manchester, N. H., through the Scientific American Patent Agency. For further information, communications may be addressed to him as above.

Electro-Typographic Machine.

A new electro-typographic machine, the invention of M. Henri Fontaine, a French barrister, is now at work in one of the public offices in Paris. The object of this machine is to print off with economy and rapidity the quantity of short papers required in law courts, public and private offices, or commercial houses, now executed by the longer and more expensive processes of printing or autography. The machine of M. Fontaine, like the electric telegraph, is on the principle of substituting fixed for movable types, one type only being employed for the same letter; thus dispensing with the ponderous and bulky movable types of the printer. Steel types, representing the different characters used in printing (capitals, small letters, italics, etc.), are ranged around [two horizontal disks, placed one over the other. Above these is another metallic circle divided into notches corresponding with the type below. By a very simple machine, as the handle or bar in the center presses against the notch representing the letter required, an electric shock lowers the type upon a sheet of paper rolled around a cylinder placed beneath, prints the letter, and again returns to its place. The operation is so rapidly performed that a hundred letters may be easily printed in a minute. When completed, the paper is transferred to the lithographic stone to be worked off. The great recommendation of M. Fontaine's machine is its great simplicity, the ease and rapidity with which it is worked, its convenient size (about three feet by two), and its moderate cost. The typography is remarkably clear and distinct, from the employment of finely engraved steel types.

Josh Billings thus speaks of a new agricultural implement, to which the attention of farmers is invited: "John Rogers' revolving, expanding, uncerimonious, self-adjusting, self-contrakting, self-sharpening, self-greasing, and self-righteous hoss-rake is now and forever offered to a generous publik. Theze rakes are az easy to keep in repair az a hitching post, and will rake up a paper of pins sowed broad kast in a ten aker lot of wheat stubble. Theze rakes kan be used in winter for a hen roost, or be sawed up in stove wood for the kitchen fire. No farmer of good moral karakter should be without one, even if he has to steal one."

Fair of the Southwestern Virginia Agricultural Society.—The second exhibition of this association will be held on their fair grounds near Wytheville, Virginia, commencing on the 27th of September, 1870, and continuing four days. A large list of premiums is offered. The secretary of the society is Alex. S. Mathews.

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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.

THE USES OF SULPHUROUS ACID.

This acid has assumed a great importance in the arts, and we find the best method for its production the frequent subject of discussion in our works on technology. It is employed as a gas, as a solution in water, and in combination with bases under the name of sulphites. There are numerous ways of making the gas, some of which it may be well to recapitulate before proceeding to speak of the applications.

One of the best methods is that proposed by Stolba, to heat in suitable retorts one part of sulphur and four parts of common sulphate of iron. Other manufacturers simply burn sulphur in atmospheric air, or deoxidize sulphuric acid by means of charcoal or some metal. In some instances, sulphurous acid is an incidental product, and is not allowed to go to waste. We do not, however, purpose to speak of the manufacture and properties of the acid, but of its uses.

In Belgium, sulphurous acid, obtained by roasting sulphur, is conducted through heaps of alum slates, arranged on floors, and, in this way, the yield of alum is greatly increased. Under the old process, sixty-eight parts of slate were required to make one part of alum. By employing sulphurous acid, it is said that eight parts of slate will yield one of alum.

In the manufacture of phosphorus from bones, the bones, previously freed from fat, are digested in aqueous sulphurous acid, by which the bone phosphate is dissolved. By boiling the solution, all of the sulphurous acid can be expelled and condensed in coke towers, to be used again. The bones thus extracted can subsequently be treated for glue. In the preservation of meat, sulphurous acid appears destined to play an important part. The meat is suspended in large boxes or chambers and sulphurous acid gas admitted. To prevent the formation of sulphuric acid, it is necessary to have something to absorb the free oxygen, such as the sulphate of iron, in the bottom of the vessel.

In the Paris Exhibition of 1855, we saw specimens of meat exhibited by Laury, which had been kept fresh in this way for five and ten years. Many of the modern processes for the preservation of meat are founded upon the use of sulphurous acid, either alone or in combination with other agents.

In the purification and refining of sugar sulphurous acid plays a most important part. Its effect is not only to clarify the molasses, but also to prevent the fermentation, by which the yield of the sugar is largely increased.

For the extraction of purpurine and alizarine from madder, Kopp proposes to treat the madder with sulphurous acid, and afterwards, with sulphuric acid. The two coloring matters are in this way separated, and the labor of extraction facilitated.

Oils and fats are purified by sulphurous acid. The fat is heated to 500° Fah., and gaseous acid passed through it for about four hours, and, afterwards, the sulphurous acid is removed by steam and water. In the refining of petroleum sulphuric acid is employed, which is partially deoxidized into sulphurous acid, and thus accomplishes the purification of the crude oil.

The preservation of hops, by impregnating them with sulphurous acid, was an important discovery, and, we believe, was chiefly due to the researches of Liebig. The gas destroys the lower forms of insect life and prevents any change in the properties of the hops.

Glue is made from leather refuse by soaking the scraps in running water and afterwards digesting them in strong sulphurous acid, and occasionally changing the water. The colorless jelly thus obtained is afterwards converted into glue.

The value of sulphurous acid, in obtaining iodine from Chili saltpeter is explained in another place. It is capable of a similar application in the treatment of copper ore, also, of the ores of many of the rare metals. Very poor copper ores are capable of being profitably worked by the sulphurous acid process.

In the manufacture of alcohol and spirits from malt, sulphurous acid has been advantageously employed. In the manufacture of sulphuric acid, and for the bleaching of straw goods, sulphurous acid has long been known. In medicine it is a valuable remedy, and rapidly attaining the first rank. For the preservation of wines and cider; to prevent the rusting of instruments; to destroy vermin; and as a disinfectant, we often hear of this acid, and the more we become familiar with its properties, the further will its uses be extended. It is one of the most important agents at the disposal of the chemist.

EFFECT OF ASSOCIATION UPON MENTAL DEVELOPMENT.

Young men, and young women, are generally ignorant of one of the most valuable as well as the most accessible and most cheap of all educating forces—the power of association on mind. This power is not commonly discovered and appreciated till experience teaches it, and when many valuable years have passed. The associations of young people here are mostly formed for the furtherance of pleasurable pursuits and without regard to mental ability or acquirements. No greater mistake can be made by a youth desirous of rising to eminence in any profession. To secure rapid mental growth, one's associates should, if possible, be chosen from those of greater mental power, wider experience, and more varied acquirements, than he himself possesses.

The profession of teaching affords many instances of the effect of constant association with inferior minds. In this profession, unless special care is taken to avoid mental contraction by occupying the mind with topics out of the usual routine, and which call into play all the faculties of the mind, men become dwarfed in intellect, and find themselves at an age when the mind should have attained its fullest vigor, less able to grapple with difficult and original trains of thought than at the outset of their professional career. It is chiefly because of the educating power of association that schools are more efficient than private instruction for youth. A young man entering college goes there not alone to learn Greek, Latin, and the sciences, but to learn human nature, to acquire self-control, to rub his wits against other wits, to encounter and resist the temptations which will beset him in after life.

All this constitutes a sharp discipline which some do not escape from unhurt. Those who do, however, are men who, having been educated by association, know the peculiarities of men in general, and are able to penetrate and understand the motions which influence action. They are not likely to fall an easy prey to deception or to over-estimate the men they encounter in active life.

This view of association as an educational force has an important bearing on the subject of schools for both sexes. Perhaps no single educational topic has given rise to more widely divergent opinion than the question of educating the sexes together or apart. So far as those who approve the mixing of the sexes in schools base their opinion upon this alleged comparative inefficiency, the admission of the power of association to educate seems to us to completely refute such an allegation. Even if it be admitted (we are by no means prepared to make such an admission, however) that these schools show at their examinations less progress made in book studies, we believe that important ends of education are subserved, which more than compensate for such deficiencies.

On this account we favor the tendency of the age to admit to colleges, seminaries, and schools, whether technical or otherwise, all students of both sexes who may desire such admission.

It is perhaps somewhat singular that in technical schools those devoted to medicine and surgery should be among the first to feel the demand of females for greater educational facilities, and to have acceded to this demand. So great a triumph over superstition and prejudice is an honor to the age. The questions of the equality of the sexes, or the mental peculiarities of each, have, in our opinion, nothing to do with the higher and more important one of equality of opportunities. Grant the latter equality, and the question of general equality will soon be settled.

WHO MAKE MISTAKES?

"Everybody," will be the reply from every one whose eye catches the above heading. A true answer, indeed. From Solomon, reputed wise, but often foolish, down to George Francis Train, often called foolish, but who not unfrequently speaks wisdom—everybody has made, and everybody will make mistakes. Adam and Eve could not live long in Eden without making a mistake, which the whole human family ought to deplore, if indeed their mistake was the cause of all the mischief in the world, which perhaps there is reason to doubt.

But who make the greatest mistakes and the most numerous? We answer those who know least, and those who are generally supposed to know most. Those who know least are those who suppose and act upon the supposition that books—the records of other men's thoughts and discoveries—are worthless, who believe in themselves as able to solve the profoundest problems without the help of previously acquired knowledge, and therefore cut and try upon questions which have long since found a thorough solution, and fritter away their time and energy to re-discover what has already been discovered. These men delight in styling themselves *practical* men, which in nine cases out of ten in which the term is used boastfully, means ignorant, obstinate men—men who never can accept an idea with relish unless they can be deceived into the belief that it emanated from their own stolid brains. How often have we seen such noodles cajoled into accepting a statement of fact, simply because some man of tact put it to them as "the same thing in another form," as some tom-fool's nonsense they had themselves uttered a few moments before. "It is only another way of putting it, you know," and, "You were entirely right in your mind about the matter," and you see them straighten up and assume the pride due to a sagacity they do not possess, and brains their skulls are too thick and too small to hold.

The mistakes of this class of men matter little to the world. It is not so, however, with the second class we have named. These are men who, having explored large areas in the field of human learning, give themselves up thereafter to profound speculation, and not content with muddling their own heads with metaphysics, print and publish their speculations to muddle others.

Among these we find the greatest and most hurtful blunders committed because their mistakes are too often accepted as truth by inferior minds.

The class of men who make the fewest mistakes, and even whose mistakes very often serve a useful purpose, lie wholly between these extremes. They are men who gratefully receiving the facts and formulæ discovered and wrought out for them by the illustrious line of workers whose labors have forever ceased, build thereon a sure structure of practical knowledge.

They are the true practical men who do not waste their time in useless original experiment unless they discover defects in the experiments, the results of which have been accepted as truth. Availing themselves thus of the store of knowledge contained in books, they make use of it in the conduct of new investigations, or in the application of them to the useful arts.

They are, in whatever degree they thus avail themselves of stored-up knowledge, the true scientific men, who avoid vain speculation and test every proposition by its accord or discord with well-established fact.

They are thus matter-of-fact men, not in the ordinary sense, perhaps, for many of them, among the most brilliant of the class, as Tyndall, Huxley, Faraday, and a host of other brilliant names, have clothed their facts in such beautiful robes of fancy that their lectures are worth reading for their literary merit alone. But they are matter-of-fact in this, that whatever conclusion they adopt must have a solid substratum of fact. These men are at the present day making such a combined attack upon all that has not fact to support it, that superstition, which has long usurped reason, finds itself unable to maintain its ground, and slowly retires before their quiet but determined onslaught.

PEN STAMMERING.

Some time since we called attention to the great necessity of simplifying our present cumbrous system of penmanship We should not, at this time, return to the topic had not our attention been called to it by the perusal of a little work written by A. J. Graham, an expert in short-hand and phonetics, whose abilities have made him well known to all the reporting fraternity in this city.

There is much in this book which is valuable, and the system set forth therein would, if adopted, save much labor. It consists mainly in the use of abbreviations, and when carried out to its fullest extent, will save some forty per cent of the labor of ordinary penmanship. But it does not appear to us to meet the requirements of modern business, be it either commercial, editorial, or clerical. What is wanted, in our opinion, is something that may be easily acquired, and easily understood, yet which shall enable the writer to spell out all words accurately, to punctuate with precision, and yet not occupy more than one half the time employed in ordinary writing. This can only be accomplished by the adoption of more simple letters, not by word contractions.

The simple forms used in short-hand writing are perfect in simplicity and legibility, and, when written out in full, give as graceful combinations as need be desired. They can be so thoroughly learned in a short time that they can be read with equal, and even greater rapidity than common long-hand, and their use saves more than half the average labor of long-hand.

There are, however, many reasons why a jump from long to short-hand, for business use, cannot be tolerated. All sound reforms necessarily are of slow growth. It nevertheless seems to us possible to hasten the ultimate abandonment of our present clumsy system for short-hand, by requiring that the system of penmanship taught in our schools should constantly tend towards simplicity rather than complication. If one hundred years since, a proposition had been made to at once eliminate all the superfluous letters in English orthography, struck from our lexicons since that date, the movement would have met with very serious opposition. This has been done gradually and written language is very much improved thereby.

A steady tendency towards reform in chirography would ultimately lead, naturally, towards short-hand, or it could, we think, be made to do so, would some genius like Mr. Graham take into consideration the best manner in which long-hand may be made to gradually approach short-hand.

We have not had time to elaborate any theory by which such a desirable result can be accomplished, but have thought

enough upon the subject to get a glimpse of possibilities in this direction which an expert might easily develop.

We trust that Mr. Graham, who has done so much for the cause of brief writing in this country, will examine these possibilities, as we are confident such examination will lead his active mind into a new and interesting channel.

RADIATION OF HEAT.

We not long since briefly discussed the communication of heat by convection and conduction, endeavoring to place in a prominent light some popular errors upon these subjects, and mistakes in the construction of steam boilers, refrigerators, etc., resulting from such errors. It will not be amiss to notice the third way by which heat is transmitted, namely, radiation.

The term, radiation, itself indicates the chief peculiarity of this mode of transmission. All the so-called radiant forces, as heat, light, attraction, etc., act from a center outwards, and all other things being equal, they act equally *in all directions*, the straight diverging lines in which they act being called rays. It must be borne in mind here, that the word center, as used above, is not employed in its strict mathematical sense, but rather means the source from which the heat or light is derived, as these modes of motion may often be generated wholly upon the surfaces of bodies.

Although, to explain the radiation of heat and light through apparently absolute space, a medium called "ether" has been supposed to exist, and although this hypothesis most admirably accounts for the principal phenomena of radiation, and changes in the direction of radiation by refraction and reflection, and though this fact gives such an hypothesis a strong claim to the very general acceptance it has received, still we must remember that it is not a demonstrated fact.

It is not, however, necessary to our present purpose to dwell upon this point, as we wish only to notice some of the most leading facts of radiation, considered in their practical application to the arts, and some facts which have been recently discovered.

A common error is the idea that "heat rises." We have already alluded several times to this error, and shown its fallacy, and we will not dwell upon it now. Suffice it to say that only when the source of heat is placed in a circulating medium, does heat even *appear* to rise.

A heated body, placed within a space void of any liquid or gaseous medium, will radiate heat *in all directions*, the intensity of the heat at any point being to the intensity of the heat at any other point inversely as the squares of the respective distances of the points from the radiating body. This is a fundamental law of radiation, which experiment has demonstrated beyond dispute.

Experiment has also demonstrated that heat radiation is affected by the physical characters of the surfaces of the radiating bodies, and this point is of considerable importance in the arts. Kettles, with smooth polished bottoms, transmit heat to the liquids contained therein much less rapidly than those the bottoms of which are blackened and rough. A steam boiler well lagged, and having the lagging inclosed by polished sheet metal, retains its heat better than by the use of the lagging alone.

Dark colored bodies radiate heat more rapidly than light colored ones. They also absorb heat to a greater extent than light colored and polished bodies. Ice would keep much longer in a bright tin pail than in a dark and roughened one. The polishing of stoves, while it improves their appearance, diminishes their radiating power.

The power of radiation is diminished by hammering and rolling metal. A hammered copper vessel is therefore not as rapid a radiator of heat as a cast one. We have often heard people wonder why copper sauce pans tinned on the interior, are preferred over all others by professional cooks. The reason is that they do not absorb and transmit heat so rapidly as vessels of iron or tin plate. They are hammered out by the coppersmith, who leaves their bottoms quite thick in proportion to the sides. The metal is thus consolidated, and being brightly tinned on the inside, and kept bright externally, the heat cannot pass through them faster than the evaporation of their contained liquids can convey it away. Thus a cook may have twenty different sauces all boiling at once, and yet he has no fear that any of them will scorch. The same reason is doubtless the basis of the favor with which copper is regarded for vessels used in distilling, sugar refining, etc.

All, or nearly all the heat existing upon the surface of the earth, may be properly traced to the radiated heat of the sun. This heat converted into various forms of force, or, according to many modern thinkers, "modes of motion," is reconverted into heat motion again in the combustion of coal, and other chemical reactions, in friction, electric resistance, etc.

Sir John Herschel and M. Pouillet found that, were no heat absorbed by the atmosphere, about 83 foot-pounds per second would fall upon a square foot of surface placed at right angles to the sun's rays. Mr. Meech estimates that the quantity of heat cut off by the atmosphere is equal to about 22 per cent of the total amount received from the sun. M. Pouillet estimates the loss at 24 per cent. Taking the former estimate, 64·74 foot-pounds per second will therefore be the quantity of heat falling on a square foot of the earth's surface when the sun is in the zenith. And were the sun to remain stationary in the zenith for twelve hours, 2,796,768 foot-pounds would fall upon the surface.

The last number of *Silliman's Journal of Science* contains an account of some investigations made by the celebrated Magnus—whose death we recently announced—on heat radiated at low temperatures. It is supposed this was his last work previous to his death.

We will close the present article by transcribing the results he obtained:

"Different bodies at 150° C. radiate different kinds of heat. These kinds of heat are more absorbed by a substance of the same kind, as the radiating body, than by others, and this absorption increases with the thickness of the absorbent.

"There are substances which emit only one or a few kinds of heat, others which emit many kinds.

"To the first of these belong rock salt when quite pure. Just as its ignited vapor, or that of one of its constituents, sodium, radiates but one color, so rock salt, even at a low temperature, emits but one kind of heat. It is monothermic, as its vapor is monochromatic.

"Rock salt even when quite clear, emits, together with its peculiar rock-salt heat, heat which is not more absorbed by a plate of rock salt 80 mm. in thickness, than by one 20 mm. in thickness.

"Rock salt absorbs very powerfully the heat it radiates. It therefore does not, as Melloni supposed, allow all kinds of heat to pass through it with equal facility.

"The great diathermancy of rock salt does not depend upon its less power of absorption for different kinds of heat, but upon the fact that it radiates only one kind of heat, and consequently absorbs only this one, and that almost all other substances send out heat containing only a small fraction or none of the rays which rock salt emits. But all rays which differ from those radiated by any substance, are not absorbed by it, but pass through with undiminished intensity. From this we may infer that every substance is diathermanous, only because it radiates but few waves of quite definite length, and consequently absorbs only these, allowing all the others to pass through.

"Sylvin (native chloride of potassium) behaves like rock salt, but is not monothermic to the same extent. In the case of this substance also an analogy exists with its ignited vapors, or those of potassium, which, as is well known, yield a nearly continuous spectrum.

"Fluor spar completely absorbs pure rock-salt heat. We ought, therefore to expect that the heat which it emits will be equally absorbed by rock salt. Nevertheless, 70 per cent of this heat can pass through a rock-salt plate 20 mm. in thickness. This may doubtless be easily explained with reference to the quantity of heat which fluor spar emits in comparison with that of the rock salt; still it is possible that fluor spar at 150° emits rays other than those which it absorbs at ordinary temperatures. This behavior is however probably connected with the great reflecting power of fluor spar for rock-salt heat.

"If it were possible to produce a spectrum of the heat radiated at 150° C., the spectrum would, if rock salt were the radiating body, exhibit only one luminous band. If sylvin were used as a radiator, the spectrum would be much more extended, but would still occupy but a small portion of the spectrum which the heat radiated from lamp-black would form."

THE COMMISSIONER SUSPENDS A PATENT AGENT FOR GROSS MISCONDUCT.

Section 17th of the Act approved July 8, 1870, provides, "that for gross misconduct the Commissioner may refuse to recognize any person as a patent agent, either generally or in any particular case; but the reasons for such refusal shall be duly recorded and be subject to the approval of the Secretary of the Interior."

The Commissioner, indeed, has had this power since 1861, but during all that time, so far as we know, the penalty has not been inflicted until now upon any agent practicing before the office. Some complaints, however, have been made against agents for irregularities, and we have reason to know that ex-Commissioner Foote had occasion to regret his leniency in one particular case of a Washington agent, who had violated the confidence of the Office by writing to the clients of another agency during the pendency of the application.

The case brought to the notice of Commissioner Fisher was that of a firm styling themselves "McGill, Grant & Co.," of Washington City, who are charged on seven distinct counts with the crime of misappropriating the moneys of their clients, and in maintaining a false correspondence in relation to the progress of business within the Patent Office.

George W. McGill, senior member of the firm, entered a general plea that the irregularities in the practice as complained of, were the result of having intrusted their Patent Office business to an irresponsible and drunken clerk. The Commissioner, however, refused to accept this answer, inasmuch as all the correspondence of the firm appears to have been carried on in McGill handwriting; and the order of the Commissioner is, "that the said firm of McGill, Grant & Co., as well as the said George W. McGill, be hereafter excluded from practicing before the Patent Office in any and all cases."

McGill has appealed to the Secretary of the Interior to examine his case, and the matter is to undergo further investigation by that official, who directs that the publication of the order be suspended.

THE PRESENT EUROPEAN WAR.

Doubtless all our readers are deeply interested in the great struggle now going on between France and Prussia. While the general discussion of its causes and probable political effect upon European affairs is foreign to the scope of our paper, we cannot refrain from calling attention to an article copied from the New York *Times* of August 17, which is decidedly the best explanation we have yet seen of the causes of the recent disasters to the French army and the success of the Prussians.

In our tour through Prussia in 1867 we were most deeply impressed with the great military strength of the nation. Not only had this kingdom at that time added to the martial spirit of its citizens by a most brilliant military success against Austria, but it was evident that in point of military organization, in the character of her arms, and the *morale* of her troops, she was then, as now, the most formidable military power in Europe.

In a letter published in this journal in August of that year we expressed the belief that the people of Prussia anticipated another war. Whether that surmise was correct or otherwise, certain it is that the event has found them fully prepared for the emergency.

Should the present war result, as now appears likely, in the defeat of France, the first rank in military prowess among the nations of Europe must be accorded to Prussia.

Our readers will find the article to which we have called attention full of instructive interest in this connection. As a fair, candid review of the situation, we commend it to their attention.

THE USE OF TORPEDOES FOR COAST DEFENSE.

It appears that the Prussians, not having a navy equal to the French, have laid a regular network of torpedoes along their Baltic coast, and at the mouths of the rivers Ems, Weser, and Elbe. Both classes of torpedo are said to be in use, the charge being in general dynamite, which, although a dangerous, is a fearfully explosive material. Many of these torpedoes are believed to be mechanical, and, if so, are exceedingly dangerous to both friends and foes. Others are arranged on the ordinary electrical principle, and are perfectly safe except when the electric communications are established. Thus the navigation of the coast, with its rivers and harbors, is quite open to the friendly ship. The merchantman fleeing like the dove from the hawk may safely steer over and among the hidden mines; yet the next moment, by the mere turn of a key, the channel may be effectually closed to the pursuer. The torpedo is the war ship's *bete noir*. The proudest iron-clad that ever floated is powerless against these submerged volcanoes.

Many English sailors remember the Russian torpedoes during the Crimean war. Harmless and insignificant as they were, yet they caused a good deal of trouble; and if they had only been on half or quarter the scale of the present mines, several English ships would be now lying in Baltic mud. We shall not be the least surprised, therefore, some morning to hear of the sudden disappearance of a nautical belligerent.

DEATH OF PROFESSOR PALMSTEDT.

The death of this distinguished chemist, the friend and cotemporary of Berzelius, occured at Stockholm, on the 6th of April, 1870, at the advanced age of 85. He devoted his long life to the good of his country. For twenty four years he was director of the polytechnic school at Gothenburg, and was thus enabled to introduce into Sweden the inventions and improvements of other countries. Technology and agriculture were his chief studies. He was the leading spirit in the organization of new schools and public exhibitions, and at the time of his death was actively engaged on a committee for the arrangement of a permanent exhibition of the products of Swedish industry, in Berlin. He made numerous journeys into foreign countries, the results of which have been published in Sweden—and among his papers have been found an extensive correspondence with nearly every chemist of note of the present century; among his letters, are 268 from Berzelius, which will be published by his executors, and doubtless throw much light on the history of chemistry.

He was a true patriot, an unselfish scholar, a useful man, and his death will be severly felt in Sweden.

SCIENTIFIC INTELLIGENCE.

TETRABROMIDE OF CARBON.

Messrs. Bolas and Groves have succeeded in preparing the tetrabromide of carbon for the first time, by heating together in a sealed tube, at a temperature of 150° C. (302° F.), for about 48 hours, two parts of bisulphide of carbon, fourteen parts dry bromine, and three parts iodine, and subsequently distilling the product off of a caustic soda solution, dissolving in hot spirits, and allowing to crystallize.

The tetrabromide of carbon is a white solid, crystallizing in lustrous plates, and melting at 195° F. It has an ethereal odor, somewhat resembling that of tetrachloride of carbon, and a sweetish taste—nearly insoluble in water, but easily dissolved in ether, bisulphide of carbon, tetrachloride of carbon, chloroform, bromoform, benzole, petroleum, and hot alcohol. It is not particularly acted upon by aqueous solutions of caustic soda and potash, or cold sulphuric acid, and with care can be sublimed unchanged. The authors have not had time to investigate the action of this interesting compound upon silver salts, ammonia, nor its physiological relations. It may prove to be a valuable salt in photography, as well as in medicine, and hence we have given a full notice of it.

ACTION OF SULPHURETED HYDROGEN ON THE SYSTEM.

Max Schaffner has recently made some observations on the action of sulphureted hydrogen that are worthy of publication, as the facts are not generally known.

When a workman remains for days or weeks in an atmosphere containing a very small quantity of sulphureted hydrogen, the symptoms are loss of appetite and headache. The sudden respiration of a large quantity of the gas produces immediate insensibility, as if the person had been shot by a bullet, all the muscles become rigid and motionless, the eyes are staring, and the lungs give out a rustling sound. Brought into the open air, and the head washed with cold water, the patient revives in a few minutes, and complains of lassitude, but not of any pain. Too long delay in such an atmosphere

would be certain death, and probably a painless one. In one instance a workman who had been rendered insensible by the gas, on his recovery had his combativeness so much aroused that he attacked the bystanders, and was with difficulty kept in bounds. The action of the gas upon the eyes is to inflame them; they become red and swollen, and finally closed, with severe pain. As a remedy, a wash composed of one third of a grain of corrosive sublimate in three ounces of water, was applied.

A mixture of air and sulphureted hydrogen is remarkably explosive. A wire heated red hot and allowed to cool until its color is dark, is sufficiently hot to occasion the explosion of the mixture. The presence of a small quantity of water vapor will prevent the ignition of the gases. Great care should be observed in factories where sulphureted hydrogen is likely to be produced, as its action is subtile, and liable to occasion unexpected explosions as well as loss of life from its poisonous effects upon the system.

PREPARATION OF OXYGEN GAS.

Robbins' method for the preparation of oxygen gas without the aid of heat, has been modified by Böttger, and is represented as affording a pure gas as readily as hydrogen can be made from zinc and dilute sulphuric acid. He takes equal weights of peroxide of lead and binoxide of barium, in a tubulated retort or flask, provided with a safety tube, and pours on weak nitric acid (9° B.); the evolution of oxygen takes place regularly, and the reaction is explained as follows: Binoxide of hydrogen is first formed, and this is at once decomposed by the peroxide of lead, and pure oxygen is liberated. The mixture of the dry lead and barium salt will keep in a well stoppered bottle, and thus the necessary reagents for the evolution of oxygen can be always on hand.

DU MOTAY'S METHOD OF PRODUCING HYDROGEN.

Dr. C. Widemann gives in the *Journal of Applied Chemistry* the latest and most economical method for the manufacture of hydrogen gas on a large scale, invented by Tessie du Motay, and explains why the old way of decomposing steam by live coals cannot succeed. The reason why water cannot be burned as a fuel with any economy is stated as follows: "First, because in the generation of steam a great quantity of latent heat is absorbed; second, because the vapor produced at temperature of 100° C., requires a considerable quantity of free heat, in order to raise it to the temperature at which it will be decomposed, and this heat must either be taken from a special apparatus for super-heating, or it must be furnished by the incandescent coal which it ought to decompose; third, because the retorts containing the carbon which decomposes the water, when brought to a red heat, and exposed directly to the steam, soon become damaged and unfit for use."

He might have added that in most cases the iron of the fire box or grates, or the nozzel of the blower is what is burned up in the production of hydrogen in this way.

Du Motay overcomes all of these difficulties in a very ingenious manner. He discovered that the hydrates of soda, potash, strontia, baryta, or lime, when mixed with charcoal, coke, anthracite, pit coal, peat, etc., and heated to redness, are decomposed into carbonic acid and hydrogen, "without further loss of heat than that due to the production of the carbonic acid and hydrogen."

The hydrates can be used indefinitely, provided they be moistened and regenerated after each operation. No special apparatus for the generation of steam is necessary, and the retorts are less liable to attack. The operation is analogous to the manufacture of carbureted hydrogen by the distillation of coal.

The invention is scarcely inferior in importance to the discovery by the same chemist of a cheap method for the manufacture of oxygen, and if the two processes can be combined, we are in a fair way of obtaining oxyhydrogen gases for metallurgical and other purposes.

With such a source of heat as this constantly at hand, the manner of reducing all metals from their ores will be revolutionized, and many metals which are now with difficulty worked, will at once become available.

IODINE FROM CHILI SALTPETER.

Professor Wagner, in his reports, says that the manufacture of iodine from Chili saltpeter already amounts to 30,000 lbs. per annum. The method invented by Thiercelin for its reclamation from the crude material is as follows: The mother liquors resulting from the manufacture of saltpeter are treated with a mixture of sulphurous acid and sulphite of soda, in proper proportion, and the iodine will be precipitated as a black powder. The precipitated iodine is put into earthen jars on the bottom of which are layers of quartz sand, fine at the top, and coarse at the bottom; from this it is removed by earthen spoons into boxes lined with gypsum, and a greater part of the water thus removed. It is sometimes sold in this impure state, or further purified by sublimation.

The Great Fire in the Woods near Ottawa.

As we are preparing for the press we receive news that the great fire in the woods near Ottawa, Canada, has completely surrounded and now seriously menaces the city. Much property has been destroyed, and quite a number of lives have been lost. North of the city, one and one half miles from the suburbs of Hull, containing all the saw mills and a vast quantity of sawed lumber, the flames are distinctly visible. If the fire reaches the lumber at Hull nothing, it is thought, can save Ottawa from destruction.

MECHANICAL MOVEMENTS.—We are in receipt of a large number of solutions to mechanical problems, published on page 71, present volume. These will all receive due attention at our earliest convenience.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

This learned body commenced its annual session at Troy, N. Y., on the 17th of August.

The Vice President took the chair, and in response to the address of welcome delivered by the Hon. John A. Griswold, thanked that gentleman for his generous recognition of the association, and took the opportunity to review briefly the work of the society, tracing its first incipient beginning in 1840, when it took being in the study of geology and natural history. In 1848 it was reorganized on a broader basis, and the mathematical sciences were comprehended in its investigations. During the four years of the rebellion no sessions were held, but in 1866 it was reorganized at Buffalo, and has achieved most important results since that time. The association to-day misses some of its most honored members. Silliman, Hare, the Rogers, Bache, Hitchcock, and Emmons are no more. Sickness holds others in bonds. Prof. Agassiz, though well enough to take the mountain air, is not yet strong enough to be with us, and Prof. Dana is too feeble to come. Prof. Henry is in Europe, and thus we lose some of our strong men. But we have strength left. There are young men here who are an honor to the cause. It must be clearly understood that this association is not a close body, designed only for the select few; it is more democratic: it enrolls all who take an interest in science, and assures all a candid hearing, no matter what his creed or country. This is the fourth time we have met in this great State, and it is proper that this Empire State should be considered by the representation of American science. It was the first State in the Union to organize a complete system of geological and natural history surveys of its territory, and is therefore classic ground for the student of those sciences. To Troy we look with interest for the success of our meeting, on account of the Rensselaer Polytechnic School—the pioneer of the kind in America—and which, having seen half a century of prosperity, is now more active than ever. To the chemist and metallurgist the extensive iron works here offer great fields for special study, such as few others in the world can equal. Here applications of science render the conversion of ore an ascertained art, and no longer a venture of empiricism. Here also are those famous Bessemer steel works, of whose wonders we have all read, and whose importance is not limited to the production of steel, but, studied by the aid of the spectroscope, throws new light on the chemical and physical constitution of the sun and the furthest nebulæ. These things are mentioned to show that the practical is dealt with by this association.

The work of organization was then resumed, and the following committee appointed: Prof. John Tarry, Prof. E. D. Cope, A. Gray, E. N. Horsford, Prof. Hillyard, and Prof. Winchell. These are on special business before the convention, and all gentlemen of great schoiarship, more than half of them presiding over most important colleges.

The Convention then divided into sections, as follows: A, Mathematics and Physical Sciences; and B, Geology and Natural History; each meeting at different places for discussion and business. Section B completed its organization before adjournment, by electing as chairman Prof. Asa Gray; Secretary, Prof. Hartshorn; Sectional Committee, Profs. Hall, Morris, and Hyatt; Committee to unite with Common Nominations, Profs. Dale, Moses, Dalrymple, and White.

Among the papers read on the 18th, and up to the time of our going to press, the only ones of much popular interest, are one on the Isothermals of the Lake Region, by Prof. Winchell, and Notes on the Condors and Humming Birds of the Equatorial Andes, by Prof. Orton.

The paper read by Prof. Winchell provoked earnest debate. The paper embodied the results of careful and prolonged observation at various localities in the region west of the great lakes as far as Nebraska. The Professor used in the illustration of the subject nine isothermal charts for several of the summer months, and winter, autumn ,and spring year mean minima and extreme minima. The professor indicated the wonderful changes in temperature caused by the great lakes in the contiguous country. The cooling influence, science attests, is exerted chiefly on the west side of Lake Michigan and the warm on the east, which depends again on the prevailing winds in summer along the shores of the lake from the east of the meridian in summer, and west of it in winter. In July, for example, the cooling influence on Lake Michigan deflects the isothermal 140 miles, while to the west of the lake they are deflected 400 miles. In January, the mean temperature on the east side of the lake is from four to six degrees higher than on the west side. The isothermals for spring show a marked cooling influence exerted on the west side, and those for the autumn a warming influence on the east side, the joint effect of which is to render the growing season six to thirteen days longer on the east side than on the west side of the lake. The most marked effect and the most surprising is felt in times of *extreme* weather, especially if cold. The isotherm of mean and extreme minima run almost literally north and south along the shore of Lake Michigan. The most excessive cold at Mackinac for a period of 28 years is not on the average greater than at Fort Riley, in Kansas, 480 miles further south. At Chicago it was one degree less than for eleven years. The isothermals for the year might be expected to show no resultant of lake influences. On the contrary, it demonstrates wonderfully the wavering influences excited on the east side; this because the liquid temperature is above that of the contiguous land. Several causes account for the increased heat of the water. The great depth of the lake (900 feet) is sufficient to secure 18 degrees of increased temperature from the earth's heated interior. This, diffused through the waters of the lake, would result in an equal and average elevation of temperature sufficient to cause the phenomena witnessed in the temperature.

In his paper, entitled "Notes on the Condors and Humming Birds of the Equatorial Andes," by Prof. James Orton, of Vassar College, said no bird has suffered more from the hands of the curious and scientific than the condor. Exaggerated stories of its size and strength continue to be published in our text-books, as, for example, that it carries off children, and that the expanse of its wings is from 15 to 20 feet, whereas it is not capable of lifting from the ground over a dozen pounds, and it is doubtful if any specimen ever measured 12 feet. Neither Humboldt nor Darwin found one over 9 feet, but an old male in the Zoological Garden, of London, measures 11 feet.

Whether this greatest of unclean birds is generically distinct from the other great vultures is yet a question among ornithologists, some including in the genus *Sarco ramphus*, the California and King vultures. My own observations of the structure and habits of the condor incline me to say it should stand alone. It is also very certain that, contrary to the usual supposition, there are *two* species of condor on the Andes. The brown kind has been considered the young of the royal black; but it is evidently distinct. The reasons for this belief were given in detail by Prof. Orton.

The largest condors are found about the Volcano of Cayambi, near Quito, and most commonly around vertical cliffs. It is often seen singly soaring at a great hight in vast circles. It never flaps its wings except in rising from the ground. Humboldt saw one fly over Chimborazi; I have seen them sailing at least 1,000 feet above the crater of Pichincha. It a marvelous eater. I have known a condor of moderate size to devour in one week a calf, a sheep, and a dog. It will eat everything but pork and cooked meat. The only noise it makes is a hiss like that of a goose. Incubation occupies about fifty days, ending in April. The young cannot fly till they are over a year old, for up to that time they are as downy goslings. While moulting, they are fed by their companions, moulting time not being uniform. There is a singular difference between the sexes, the eyes of the male being light brown and in the female bright red. The females are also smaller in size, and want the crest and wattle. The toes are less prehensile than those of other Raptores. Professor Orton also gave some new facts respecting the Hummers of the Andes as the result of his own observations. The group *Polytminæ* comprises nine tenths of known species. Their headquarters seem to be New Granada. Many of them are restricted to very narrow localities. Of the 430 species known, 84 are found in Ecuador. If the wanton destruction of specimens for decorative purposes continues, several genera will soon be exterminated.

Nidification is uniform at the same altitude and latitude. In the valley of Quito it occurs in April. The nest is built in six days. Some are cup-shaped; others hang like a hammock by spiders' webs, while the long-tailed species constructs a purse-shaped net. Prof. Orton here exhibited several specimens to show how strikingly the nests of the Andean species differ from those of our own hummer—the latter being covered with lichens, and the former invariably with moss. The usual number of eggs laid is two, and these are of a pinkish hue. Incubation lasts twelve days at Quito, and there is but one brood a year, though two in Brazil.

Models for the Patent Office.

Under the new law the Commissioner may, at his discretion, dispense with models when application is made for a patent, but he does not propose to relinquish the requirement except in cases where the invention can be clearly understood without a model. In dealing with our clients we shall be very careful to advise them when we think a model may be dispensed with. Examiners as a rule are opposed to doing away with models, and the case must necessarily be a clear one before they will consent to act without them.

ALASKA FURS.—Notice has been received at the Treasury Department of the arrival of the steamer *Alexander* at San Francisco, from Alaska, freighted with the seal fur product of 1869. She brought 60,992 skins taken on the island of St. Paul, and 24,909 skins taken on the island of St. George, making a total of 85,901 skins, upon which the owners are required to pay a tax to the United States of one dollar upon each skin. The same vessel brought 1,688 fox skins from the same islands, but as the law imposes no tax upon these the question has been submitted to the Treasury officials as to allowing them free of duty.

THE CHASSEPOT AND THE NEEDLE-GUN.—A private letter from an Englishman, dated "Saarbrücken, says: I can't help reiterating that in all the shooting there has yet been the Prussians have had out and out the best of it. Nothing could be worse than the Chassepot at short ranges. We see the Frenchmen spitting on their cartridges, sticking their fingers into their guns, and giving every possible sign that, after a few shots, the Chassepot gets so foul they don't know how to treat it."

CLOGGING OF BOLTING CLOTHS.—Messrs. Glen & Wright, of Atlanta, Ga., referring to a letter from a correspondent complaining of the clogging of bolting cloths, state that the Godfrey Patent Flour Cooler Bolt and Cleaner meets every exigency of the case.

INVENTORS who desire to know in advance respecting the novelty of their inventions, can have a careful preliminary examination made at the Patent Office for a fee of $5. Address (inclosing sketch and description) the publishers of this journal.

The Infection of Rivers by Manufactories.

The continual discharge of the waste of manufacture into adjacent rivers, and consequent impurity of the water, its unfitness for domestic purposes, and its danger to hygiene, have been the subject of an investigation by an English commission, by which some interesting and important facts were brought out.

The little river of Irwel, which flows through Lancashire, is as clear and limpid as a crystal at its source. Two miles and a half from where it rises is Bacup. Before it reaches the latter place, it has already taken up the impurities of nineteen cotton mills, two dye-houses, a printing establishment, one saw and two flour mills. Now Bacup adds to its impurities, and immediately below it follow thirty cotton and woolen factories, six gum factories, tan yards, print works, clay works, saw mills, a porcelain and gas factory. No wonder that at Ramsbottom the river is "infected and black as Styx." At Manchester, however, the Irwel reaches nearly the maximum of impurity, holding 58·8 per cent of solid matter in suspension, and 9·43 per cent of chloride in solution. It has at that point received the waste of *ten thousand* different manufacturing establishments, besides the impurities of the cities and villages on its banks. "In view of such facts," says the report, "we have only one feeling and one word by which to express it—it is hideous." Of course this is one of the worst instances; but there are certainly many which are not much better.

From the conclusions of the English committee, we extract the following: Heretofore, it was believed that the sewage emptied into a river was oxidized at the expense of the oxygen inclosed in the water, and finally disappeared entirely. This would be a very convenient method of purification. Something similar was supposed to take place, as in the case where dirty water is poured on cultivated land, and filters through the soil. After this filtering it is free from impurities; the organic matter has been transformed into carbonic acid; but unfortunately, this theory does not hold true; a mass of impurity is not destroyed in running water, and we must cherish no illusions in this respect. There is only one effective method of meeting the danger; the sewage and waste, before being emptied into a river, must be subjected to a filtration which deprives them of their noxious germs and impurities; it is sufficient to pass them through some porous substance which retains the solid matter, and oxidizes the soluble substances.

The commission has, moreover, established the fact that the irrigation of a large extent of land with sewage water is not attended with any danger to the public health; after a few days the disinfection is complete. The conclusions of the English commission coincide entirely with the results obtained in France by experiments made near Asineres and Clichy, and may be taken as the basis of any regulations which, in due time, it may become necessary to adopt in our own crowded manufacturing districts, for the preservation of the purity of our rivers.—*Manufacturers' Review.*

Errors in the Treatment of the Horse.

In the midst of change, improvement, reform, says the Philadelphia *Ledger* quite a number of questionable old notions continue to be followed, even now when the very erroneous character of some of them has been acknowledged. Of this character is the rigid adherence of a majority of drivers of horses to that useless and injurious relic of old times, the check-rein. Its use with draft horses is positively cruel. When a horse is drawing a heavy load, and particularly "up hill," he needs the utmost freedom of lungs and wind, and this he can never have with a tight check-rein. That the check rein prevents a horse from stumbling is more than doubtful; on the contrary, by elevating his eyes, it prevents him from seeing clearly where to place his foot. When a horse does stumble, he is far less likely to go down when his head is left free.

In England, where they are far ahead of us in everything pertaining to horses, the check-rein has been abolished; the last surrender being that of the artillery and commissariat trains of the British army, the change having been made by Sir George Burgoyne, the Commander-in-Chief, and he testifies to the beneficial effects attending it.

In New York city, thanks to Mr. Bergh, many of the finest equipages are driven without the check-rein, and a few humane people have thrown it out of use here. The old-fashioned "blinkers," or blind-halters, are also useless, if not positely injurious, by coming in contact and rubbing the lids of the horse's eyes; and many experienced horsemen long ago came to the conclusion that horses are more easily alarmed by what they hear and do not see, because, being intelligent animals, if they can fully see the objects, which when unseen or imperfectly seen, tend to frighten them, they are more readily calmed.

Another popular error, which bears hard on the horse, is the custom of making the axles of conveyances of all sorts of one uniform width. This custom is of ancient date, and it has caused great detriment to our public highways, both in town and country. It is not, perhaps, saying too much to assert that the uniform adherence to it has caused our Highway Department for the last fifty years hundreds of thousands of dollars. Had there been a latitude or play of from ten to twelve or fourteen inches in the tread of the wheels, especially in carts and wagons, it would have been impossible to have cut our pavements into the ruts we now see, and which renders hauling so difficult along our streets and roads. Like the Connestoga wagons of the last generation, with their broad tires, a difference in the width of our axles would have improved rather than damaged our highways, and we should not see them cut into alternating ridges and ruts, as so many of them are now

How to Utilize a Hen Roost.—A genius by the name of Jeremiah Cory, of Holden, Mo., has recently taken out a very novel patent. The invention consists in so combining and arranging a poultry roost with the gates of one or more beehives that the perching of the poultry upon the roost will serve to automatically close the hives. The object is to insure the closing of the hives at night, so as to exclude the bee-moth, and the opening of the same in the morning to permit the passage of the bees in and out during the day. The genius of our people is equal to all emergencies.

A Correction.—A letter published in our issue of August 6th, accredits the building of the steamer *Robert E. Lee*, which lately figured in a race upon the Mississippi River, to Louisville, Ky. Mr. A. S. Roger, Jr., of New Albany, Ind., now writes us that this steamer was built at the latter place, he himself having built her cabin.

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.

G. B., of Ind.—The following directions for soldering aluminum have been already published in this journal. However, for your benefit, and that of other new subscribers, we will reprint them here: "Mouray, of Paris, employs five different solders, which are composed as follows:

No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	
80	85	88	90	94	parts in weight of zinc.
8	6	5	4	2	" " copper.
12	9	7	6	4	" " aluminum.

"These ingredients are melted in a crucible. The copper is fused first, and the aluminum is then added in three or four portions. When the whole is liquefied, it is stirred with an iron rod. The crucible is then withdrawn, and the zinc introduced into the mass under constant stirring. It should be free from iron. The liquefied mass is poured in ingot-like molds, which have been wiped out with benzine. The selection of the solder depends upon the nature of the object. In order to quicken its fusion on the metal, a mixture of three parts of balsam of copaiba and one part of Venetian turpentine is made use of; otherwise the operation is performed in exactly the same manner as in the brazing of other metals. The aluminum solder is spread without delay on the previously heated surfaces to be fastened together. In heating, the blue gas flame or the turpentine blast lamp is employed. The more and oftener the solder is spread over the surface the better it is."

J. H. S., of ——., asks whether in weighing a load on a wagon, by first driving on to the scale the fore wheels, weighing, and noting the result, then drawing off the fore wheels and drawing on the hind wheels, weighing, and noting the result, then discharging the load, weighing the wagon, and deducting its weight from the sum of the two previous weights, the correct weight of the load would be obtained.—If the wagon were constructed so that the fore and hind wheels sustained equal portions of its weight, and if the load were so placed that the fore and hind wheels sustained equal parts of *its* weight, and if the wheels were exactly load and wagon in each of the two first weighings rested upon the scale, the position of the wagon being so adjusted in each weighing that this precision could be secured, the correct weight could be ascertained in the manner specified. The chances that all these adjustments could be made under ordinary circumstances, are not one in a billion.

J. R., of Ohio.—We do not believe application of paint in the extreme heat of July or August, will materially aid the chemical changes, which take place ultimately in all paints which contain lead. Although heat facilitates most chemical reactions, the differences between the temperature of what are usually called hot days, and those called cool, in summer, is scarcely ever more than twenty degrees in the shade. The cracking off, and change of color in the mixture of white lead, red lead, and yellow ocher, of which you speak, is doubtless due to some defect in the vehicle, or adulteration in either or both vehicle and pigments.

H. B. G., of N. J.—We do not believe that wetting down the ashes in the ash-pit of your boiler, to preserve the grate, is so good a practice as to rake them out after slicing the fire, though of course the cooler you keep the pit the longer the grate will last. Wetting down with the hose is a "mussy" operation, and helps to disintegrate the masonry. Cooling the pit in this way will not injure the draft, but we should think it would not be necessary with the depth and size of your ash-pit.

P. P. P., of N. Y.—We do not know of any way to make the mixture of gl e and glycerin, used for printer's rollers, water proof. We do not thin there is any way known. None of the chromates or bichromates, or tannin, though acting upon the glue, would, in our opinion, answer for this purpose. If any one knows of any means whereby this can be accomplished, we shall be glad to hear from him.

R. H., of Ohio. The words, belt, band, and strap, are equally appropriate, applied to flexible leather or rubber connectors of pulleys. In this country, belt and band are more commonly used. In English works we frequently meet the word strap used in this way. The word belt is one most in use among American mechanics.

D. L. B., of N. H.—You have, it seems, stumbled upon a well-known fact. If you will take another hardened steel rod, and hold it in the line of the magnetic dip, at your locality, and strike it as before with the hammer, you will develop magnetism in it also, and may count upon the same result, as often as the experiment is repeated.

G. H. M., of Va.—When the attraction and repulsion of the molecules of a mass are in equilibrio, the physical state of the mass is a liquid, and not a solid, as you assume. This error wholly vitiates your conclusions.

J. B., of N. Y.—Your question in regard to the tension of hollow shafts cannot be answered. You appear to be confounding horse power with static pressure.

G. F. M., of Mass.—We think a solid rubber or tanite emery wheel will answer your purpose for surfacing down pieces of plate steel much better than anything else.

H. C. P., of Mich.—We shall publish no more communications upon the subject of inertia at present. The question is one which we think does not generally interest our readers.

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 $15. Address MUNN & CO., 37 Park Row, New York.

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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.

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Recent American and Foreign Patents.

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

APPARATUS FOR FORCING WATER.—James M. Rucker, Forrest Depot, Va.—This invention consists in the combination of a subterranean reservoir, so situated that it may receive water from the surrounding earth, with a pipe for introducing air under pressure into the upper part of the reservoir, a pump for supplying such air and putting the requisite pressure upon the same, and with a second pipe for conducting the water forced out the reservoir by the pressure of the introduced air to the spot where it is needed.

HOISTING JACK.—Frank Hollenberry, Frizellburgh, Md.—This invention consists of a stationary upright frame provided with a centrally vertical sliding bar, which is raised and lowered by means of two levers, one of which serves to hold the bar at the hight to which it had been raised, while the other is taking a fresh hold, both levers operating upon the bar through the medium of clamps which bite the bar, one when pressure or weight is applied to the bar and the other when pressure is applied to the lever.

MACHINE FOR CUTTING SLATS FOR WINDOW BLINDS.—John W. Helder, Shannon, Md.—This invention has for its object to cut from a piece of wood of any dimensions a splint or slat of the proper width and thickness, such slat passing off through the stock in the same way that shavings are conducted away in an ordinary plane.

SHEAVE BLOCK.—Thos. H. Rice, Baltimore, Md.—This invention consists of friction rollers, mounted in boxes, which are placed in both the inner sides of a pulley block in such manner that the rollers project inward beyond the surfaces of the sides, so as to prevent the sheaves from coming in contact with the block, and wearing the same away.

TILE-CUTTING MACHINE.—Oscar F. Monfort, Dearborn, Mich.—This invention relates to improvements in machines for cutting the tile as it issues from the tile machine in continuous form into short sections, and consists in the application to the carrying table between two endless belts of a fine wire or steel-plate cutter, stretched between an arm and a shaft, by which the arm is revolved so as to be revolved around the shaft and forced through the tile while moving along, the cutter being arranged to move with the tile, while cutting, and back again after cutting, and the arm which supports the swinging end of the cutter being arranged to pass between the cut sections. The invention also comprises a carrying table, for passing the cut pieces beyond the arm which supports the cutter suspended on the shaft, and held in position by a weight, so that the arm which carries the cutter may pass around it.

RAILROAD SWITCHES.—J. H. Stockton, Thompson, Ga.—This invention relates to improvements in railroad switches, and consists in the application to the switch rails or the bars, for moving them of a weight, and suitable levers or gears, and a holding and tripping lever, so that the tripping bar or lever being moved by the wheel of the advancing locomotive will trip the weight and let it fall to close the switch.

MAINSPRING WINDER.—Michael D. Kelly, Cadiz, Ky.—This invention relates to improvements in tools for winding the mainsprings of watches and inserting them in the barrels, and consists in a pair of bars pivoted together at one end by a compass or rule point, and having a semicircular recess at the free ends for the reception of the spring, to be coiled therein by a winding shaft of any kind, and the said bars are provided with gaging springs to vary the depth of the recesses; also with pins for gaging the recess to receive the spring and for controlling the relation of the winder with the winding shaft. The said bars are also provided with an opening spring and closing screw.

DIAPER PINS.—Isaac W. Stewart, New York city.—This invention relates to improvements in the construction of diaper pins, and consists in an improved mode of constructing the shield and attaching it to the pin.

PRESSES.—G. W. Swinebroad, Bolivar, Tenn.—This invention relates to improvements in hay, cotton, and other presses, and consists in operating the follower by means of levers, links, gripping blocks, and vertical bars, the gripping blocks working on the vertical bars.

WATCHMAKERS' TOOL.—Michael D. Kelly, Cadiz, Ky.—This invention relates to improvements in tools for watchmakers' and repairers' use, for holding the watch plates and other articles, also for holding the tools with which the work is done in all operations now commonly done in a lathe, such as drilling, milling, jewel setting, freeing, gaging, pinion centering, uprighting, and the like. The said improved tool is also applicable for the uses of an anvil.

MACHINE FOR TURNING AXLETREES.—William H. Heffley, Rochester, Ind.—This invention has for its object to construct a machine for turning the ends of axletrees so that the same will correspond exactly with the pindles or thimbles into which they are to be fitted. The invention consists chiefly in providing a mechanism, whereby the inner form of the thimble is exactly transferred to the outer side of the axle, that is to say, a set of levers whose ends are pressed against the inner face of the thimble control the cutters which turn the axle.

TRUSS PADS.—Dr. S. S. Ritter, Philadelphia, Pa.—This invention consists in a new method of manufacturing pads for trusses, whereby the time and expense of the same are materially reduced as compared with that attending the ordinary method.

SPRING WAGON SEAT.—G. W. Diller, Odell, Ill.—The object of this invention is to furnish an improved device for attaching springs of wagon seats to wagon boxes or bodies, whereby the strain upon the springs and box shall be greatly lessened and also other obvious advantages obtained.

FENCE.—William Bartlett, Little Hocking, Ohio.—This invention relates to a zigzag or worm fence, and consists in posts planted at an inclination all leading inward or toward the vertical plane cutting centrally length, wise of the fence for the purpose of rendering the fence firmer than as though the posts were upright.

CORN HUSKER.—S. L. Bligh, Sandy Lake, Pa.—The object of this invention is to construct an instrument by means of which the husking of corn can be accomplished in an easy and expeditious manner.

HAIR TRIGGER ATTACHMENT TO FIRE-ARMS.—Joseph Deutz, San Antonio, Texas.—This invention relates to a new hair trigger attachment which is applicable to fire-arms of all kinds, and of such simple construction that it will be reliable and durable.

BARBER'S FURNITURE.—Otto Stoelker, Montgomery, Ala.—This invention relates to a new apparatus which is to be set up in barber shops with an object of economizing time and labor, and preventing waste of material.

MOLDING CUTTER HEAD.—Darius Stevens, Danbury, Conn.—This invention has for its object to furnish an improved cutter head for holding the cutters for forming moldings, which shall be simple in construction, convenent in use, and will hold the cutters securely.

FAN BLOWER.—John Ericsson, New York city.—This invention relates to a new multiplying fan blower of that class in which a series of wings are rotated between a series of diaphragms for compressing the air by centrifugal force, and utilizing it in the compressed state for suitable purposes. The invention consists chiefly in the use of a rotary case and stationary shaft instead of the rotary shaft and stationary cases heretofore employed. The necessity of constructing the case in sections, so as to enable the introduction of the several wings that are mounted upon the shaft, is thus overcome and the case may be made in one single piece, and consequently much cheaper than the ordinary blower now in use. The amount of rotating surface gained by making the case revolve adds also considerably to the efficiency of the machine.

CAR COUPLING.—J. H. Johnson, Dresden, Mo.—The object of this invention is to provide a coupling for railroad cars whereby the inconvenient links and the necessity of handling the same can be dispensed with. The invention consists in making the coupling boxes or main and saw heads serve the purposes of links, so that those of two cars can be locked together by means of a horizontal coupling pin dropped in from above

LATH SAWING MACHINE.—J. J. Knowlton, Philadelphia, Pa.—This invention relates to a new construction of machine for sawing laths, pickets etc., and consists in the application of vertically adjustable guides, which hold the sawed pieces and prevent them from springing or twisting on the saws. The invention consists also in setting the feed rollers at an angle, *i. e.*, slightly oblique, so that they will crowd the stuff against the stationary guide or fence, and thereby the requisite straight guidance will be obtained.

FENCE POST.—O. L. Larkin, Otto, N. Y.—This invention has for its object to reduce the expense and increase the durability of fence posts, and consists in making the foot or lower part of each post of metal, while the upper part is made of wood to allow the nailing on of planks, etc.

DRAIN AND WATER-PIPE MACHINE.—John W. Stockwell, Portland, Me.—This invention has for its object to furnish a simple and convenient machine for forming drain and water pipes, which shall be so constructed and arranged as to pack the material uniformly throughout the length of the pipe.

GUIDE FOR CIRCULAR SAWS.—Alexander Middlebrook, Glasgow, Mo.—This invention relates to a new guide for circular saws, which is so constructed that the pins can be simultaneously moved in the same direction, without requiring to be directly handled. The hands of attendants will thereby be kept from dangerous contact with the saw.

STEAM GENERATOR.—Joseph A. Miller, New York city.—The object of this invention is to construct a steam generator, which will insure a thorough circulation of the water, to expose the same to all the heating surfaces, and in which the steam will be effectually separated from all water that may arise with it into the upper steam passage. The invention consists in the application to a vertical or inclined water and steam chamber of a series of continuous circulating pipes, of which each enters the chamber with both ends. Each pipe receives water at the lower, and discharges steam at the upper end, and the steam is therefore produced by the circulation of the water through the said pipes.

COFFEE MILL.—F. C. Richer, Gilmer, Texas.—The object of this invention is to simplify the construction of upright coffee grinders, so that the same can be made cheaper and stronger than heretofore. The invention consists in constructing the entire mill of three pieces, the grinder being one, while the case or shell is made of two parts.

HAY LOADER.—William H. Gray, Ashfield, Mass.—This invention relates a new and useful improvement in machines for loading hay, whereby that laborious operation is performed by horse power, and in the most expeditious manner.

SELF-ACTING COMPRESSION FAUCET.—Edward Noble, North Haven, Conn.—This invention relates to a new and useful improvement in faucets, and consists in an arrangement whereby the faucet valve is closed by the pressure of the fluid, and opened by means of a lever and inclined plane.

PORTABLE GAS-PIPE VISE.—Thomas Marshall, Paterson, N. J.—This invention has for its object to furnish an improved portable vise for holding gas pipes, while being cut off, or having screw threads cut upon their ends, and which shall be so constructed that the workman can conveniently carry it in his bag, and which may be readily attached to a bench, table, or other support.

VINE CUTTER OR TRIMMER.—H. W. White, Joppa Village, Mass.—This invention has for its object to furnish an improved implement for cutting or trimming the runners from strawberry vines, planted in hills, which shall be so constructed as to cut off all the runners from the hill at a single operation, and which shall at the same time be simple in construction, effective in operation, and conveniently operated.

SLIDE CHUCK FOR LATHES.—C. F. Stackpole, Woburn, Mass.—This invention has for its object to furnish an improved slide chuck for lathes, designed more particularly for holding cranks while being turned, but equally applicable for holding other work, and which shall be simple in construction, and easily adjusted.

SEPARATOR ATTACHMENT FOR THRASHING MACHINES.—Moses A. Keller, Littlestown, Pa.—This invention relates to improvements in grain separating and winnowing apparatus, and consists in a straw carrier, composed of long bars, carrying teeth and short bars, mounted near each end to crank shafts, which move them up and down, and forward and back, over an ascending table, composed of transverse slats or bars with spaces between, made adjustable to vary the spaces, which let the grain and chaff through to an endless carrier, which takes it up to the hopper of the winnower, arranged under the case of the carrier. The said case and the case containing the straw-carrying attachment, are made in two parts, and arranged for detaching the carrying apparatus to use the winnower alone. The invention also comprises a regulating apparatus for the winnower, to open or close the air passages, and a straw-carrying attachment. It also comprises certain improvements in driving gear for working a secondary straw carrier.

AXLE GAGE.—Rollin C. Kelly, Brandon, Wis.—This invention relates to a new and useful improvement in apparatus for obtaining the true bevel for the arms of the axles of wheeled vehicles.

STEAM BOILER.—D. A. Morris, New York city.—This invention relates to new and important improvements in steam boilers, whereby they are made much more safe, durable, and effective than boilers of ordinary construction.

MACHINE FOR MAKING MATCH SPLINTS.—Denslow Burhaus, Burlington, Iowa.—This invention relates to a new and useful improvement in machines for making splints for lucifer matches, whereby that operation is greatly facilitated.

POUNCING MACHINE.—John Rosenkranz, Boston, Mass.—This invention relates to a new and useful improvement for machines for pouncing hats whereby the labor is greatly lessened and the operation is performed in the most thorough and expeditious manner.

BEDSTEAD FASTENING.—P. Maulding and John U. Fraley, Marshall, Texas.—This invention relates to a new and useful improvement in mode of fastening the rails to the posts of bedsteads, whereby many of the objections to the ordinary bedstead fastening are obviated.

TURNING AND SCREW-CUTTING LATHES.—Philip H. Pitts, Waverly, Mo.—This invention relates to improvements in turning and screw-cutting lathes, and consists in a lathe so arranged that, by shifting some of the parts, it may be readily adjusted either for turning or cutting screw threads on bolts.

STEAM PUMPING ENGINE.—Thomas E. Blunt, Brookfield, Ohio.—This invention relates to a new and useful improvement in steam steam pumping engines, and consists in exhausting the steam from the engines into the discharge pipe of the pump, thereby making a condenser of the discharge, and materially increasing the efficiency of the engine.

SLIDING DOOR FOR STREET CARS.—Daniel R. Hart, St. Louis, Mo.—This invention has for its object to furnish an improved sliding door for that class of street cars known as the fare-box car, and which has heretofore been made with a swinging door and covered step, so to render said cars more convenient in use, both for driver and passengers.

SPRING BED BOTTOM.—Chas. T. Baade, Brooklyn, N. Y.—This invention relates to improvements in the construction and arrangement of spring-bed bottoms in which long wood slats or springs are used in combination for the head and center of the bottom, the foot ends of the wood springs being arranged to rest on a wood bolster or cross-piece of the frame, and the head ends being bent and suitably shaped to be used in substitution to the stuffed bolsters sometimes used.

DITCHING PLOW.—S. S. Wood, Brooklyn, N. Y.—This invention relates to new and useful improvements in plows for cutting ditches for laying drain tile, draining off water, or other purposes, and consists, firstly, in a device for adjusting the beam vertically, so that the pitch of the plow may be varied as it descends in the process of cutting the ditch; and, secondly, in an adjustable branch handle, on the standard handle, by means of which the attendant is enabled to guide and control the plow, as it descends, while walking on the surface of the ground.

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FOR THE WEEK ENDING August 14, 1870.

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106,302.—LAMP BURNER. — Benjamin F. Adams, Boston Mass.
106,303.—LAMP BURNER. — Benjamin Franklin Adams Boston, Mass.
106,304.—EQUALIZING THE MAINSPRING OF TIME-PIECES.—J. P. Adams, Ipswich, Mass.
106,305.—CUTTING APPARATUS FOR HARVESTERS.—Henry C Aydelott, Carthage, Ind.
106,306.—HARNESS-OPERATING MECHANISM FOR LOOMS.—John Ashworth, North Andover, Mass.
106,307.—SEWING MACHINE.—M. M. Barnes, North Adams, Mass.
106,308.—STONE-SAWING MACHINE.—Charles Bateman, Baltimore, Md.
106,309.—TOP PLATE OF COOKING STOVE.—Milton Bennet, Dayton, Ohio.
106,310.—CHISEL FOR CUTTING GAINS.—Hiram Bigelow, Skowhegan, Me.
106,311.—HAND CORN HUSKER.—S. L. Bligh, Sandy Lake, Pa.
106,312.—STEAM PUMPING ENGINE.—T. E. Blunt, Brookfield, Ohio.
106,313.—COMPOUND FOR FERTILIZER.—Gustave Bourgate, New York city.
106,314.—FOOT MEASURE.—John C. F. Bremser, St. Louis, Mo.
106,315.—HINGE.—J. D. Brown, Madisonville, Ohio.
106,316.—SPRING BED BOTTOM.—C. T. Baade, Brooklyn, N. Y.
106,317.—DEVICE FOR LEVELING BILLIARD AND OTHER TABLES, ETC.—B. W. Bull, New York city.
106,318.—TABLE.—Ernst Brucker, Old Tappan, N. J.
106,319.—MACHINE FOR MAKING MATCH SPLINTS.—Denslow Burhaus, Burlington, Iowa.
106,320.—COMBINED DRILL AND SEEDING MACHINE.—J. E. Buxton, Owattonna, Minn. Antedated July 2, 1870.
106,321.—PADDING FOR HARNESS.—James Cormac and Alex Stobbs, Hector, N. Y.
106,322.—MANUFACTURE OF RESIN SOAP.—D. B. Chapman, New London, Conn.
106,323.—TABLE KNIFE.—Matthew Chapman, Greenfield, Mass.
106,324.—PROTECTING SAFES AND VAULTS FROM BURGLARS.—C. T. Chester, Englewood, N. J.
106,325.—POST-OFFICE CABINET FOR SUNDAY-SCHOOL AND OTHER ROOMS.—Wm. M. Clark and Alexander Clark, Pittsburgh, Pa.
106,326.—WELL BUCKET.—Alvens J. Clemens, Aberdeen, Miss.
106,327.—ROOFING FELT.—W. B. Coates (assignor for one half his right to Joseph Leeds), Philadelphia, Pa. Antedated August 4, 1870.
106,328.—GARTER.—Charles Coester, Jr., and Jas. L. Moore, Bridgeport, Conn.
106,329.—STRAW CUTTER. — Samuel Colahan, Cleveland, Ohio.
106,330.—APPROACH GATE.—S. H. Cole, East Enterprise, Ind.
106,331.—PADDLE WHEEL.—R. H. Connelly, Philadelphia, Pa.
106,332.—STRETCHER FOR PICTURE FRAME.—J. D. Crocker, Norwich, Conn.
106,333.—COMPOUND FOR CURE OF COUGHS, ETC.—John Cushions, Wellington, Ohio.
106,334.—LOOM.—H. D. Davis, North Andover, Mass.
106,335.—SHEAVE.—H. D. Davis, North Andover, Mass.
106,336.—HORSE HAY RAKE.—S. L. Denney, Christiana, Pa. Antedated August 5, 1870.
106,337.—GUN LOCK.—Joseph Deutz, San Antonio, Texas.
106,338.—SPRING SEAT FOR VEHICLES.—G. W. Diller, Odell Ill.
106,339.—PITMAN CONNECTION FOR HARVESTERS.—Joseph Dixon and M. B. Sampson, Eddyville, Iowa.
106,340.—EXTENSION TABLE SLIDE.—William Donoghue, Philadelphia, Pa.
106,341.—HAME FOR HARNESS.—Wm. Duncan, Spring Hill, Ind.
106,342.—HARVESTER RAKE.—Wm. T. Eastes, Summitville, Ind.
106,343.—INVALID CHAIR AND LOUNGE.—William T. Eastes, Summitville, Ind.
106,344.—PLOW.—Isaac Eastwood, Lanark, Ill.
106,345.—RECORDING PRESSURE GAGE.—Jarvis B. Edson, Brooklyn, N. Y.
106,346.—INDIA-RUBBER SHOE. — Lewis Elliott, Jr., and George H. Fowler (assignors to L. Candee & Company), New Haven Conn.
106,347.—MANUFACTURE OF WROUGHT AND PUDDLED IRON.—William Ennis, Philadelphia, Pa.
106,348.—FAN BLOWER.—John Ericsson, New York city.
106,349.—BENCH VISE.—G. M. Evans, Pittsburgh, Pa.
106,350.—RAISIN SEEDER.—H. G. Fiske (assignor to Geo. L Taylor and Dwight Holland), Springfield, Mass.
106,351.—HINGE.—Charles Gaylord, Washington, D. C.
106,352.—OVEN.—D. J. George, Arcade, Ind.
106,353.—TABLE-LEAF SUPPORTER.—George L. Gerard, New Haven, Conn.
106,354.—CULTIVATOR.—John L. Graham, Bentley Station, Ill.
106,355.—HAY LOADER.—W. H. Gray, Ashfield, Mass.
106,356.—BUCKLE WITH BUTTON-HOLE ATTACHMENT.—B. J Greely, Boston, Mass.
106,357.—APPARATUS FOR RAKING AND BINDING GRAIN.—T. K. Griffith, Redstone, Pa. Antedated August 4, 1870.
106,358.—STEERING APPARATUS.—Charles Godfrey Gumpel, No. 49 Leicester Square, London, England. Patented in England Nov 2, 1869.
106,359.—MACHINE FOR PREPARING APPLES FOR THE MANUFACTURE OF CIDER.—G. B. Hamblin, Willimantic, Conn.
106,360.—GEARING AND SELF-ADJUSTING SHAFT.—George B. Hamlin, Willimantic, Conn.
106,361.—WHEEL HUB.—J. B. Hards, Chicago, Ill.
106,362.—DOOR FOR STREET CARS.—Daniel R. Hart, St. Louis Mo.
106,363.—LAMP BURNER.—H. W. Hayden (assignor to Holmes, Booth & Haydens), Waterbury, Conn.
106,364.—MACHINE FOR TURNING AXLE TREES.—William H. Heffley (assignor to himself and David Barb), Rochester, Ind.
106,365.—MANUFACTURE OF IRON AND STEEL.—James Henderson, New York city

106,366.—Manufacture of Boot and Shoe Soles.—Eugene Ibos, Paris, France.
106,367.—Railway Car Coupling.—J. H. Johnson, Dresden, Mo.
106,368.—Key Hole Guard.—J. H. Jones, Binghamton, N. Y.
106,369.—Egg Carrier.—E. E. Joseff, St. Louis, Mo.
106,370.—Separator Attachment to Thrashing Machines.—M. A. Keller, Littlestown, Pa.
106,371.—Watch Making Tool.—M. D. Kelly, Cadiz, Ky.
106,372.—Device for Winding Mainsprings of Watches.—M. D. Kelly, Cadiz, Ky.
106,373.—Axle Gage.—R. C. Kelly, Brandon, Wis.
106,374.—Lath Machine.—J. J. Knowlton (assignor to himself and W. H. Burr), Philadelphia, Pa.
106,375.—Fence Post.—O. L. Larkin, Otto, N. Y.
106,376.—Harrow and Cultivator.—John Lerch, Uhlersville, Pa.
106,377.—Bee Hive.—Volney Leonard, Springfield, Pa.
106,378.—Railway Carriage.—A. R. Locke, Boston, Mass.
106,379.—Carriage Jack.—David Marshall, Northville, Mich.
106,380.—Portable Gas-Pipe Vise.—Thomas Marshall, Paterson, N. J.
106,381.—Corset Spring.—F. W. Marston, Philadelphia, Pa.
106,382.—Bedstead Fastening.—Pres. Maulding and J. U. Fraley, Marshall, Texas.
106,383.—Galvanic Battery.—E. D. McCracken, New York city.
106,384.—Paint Brush.—Alvid McDonald and J. M. White, Washington, Ill.
106,385.—Horse Hay Rake.—G. M. L. McMillen, Dayton, Ohio.
106,386.—Mosquito-Net Holder.—Charles Messenger, Cleveland, Ohio.
106,387.—Guide for Circular Saw.—Alexander Middlebrook, Glasgow, Mo., assignor to himself and J. B. Ruthvin.
106,388.—Steam Generator.—J. A. Miller, New York city.
106,389.—Carbureting Apparatus.—Joseph Millward, Fayetteville, N. Y.
106,390.—Tile Cutting Machine.—O. F. Monfort, Dearborn, Mich.
106,391.—Veneering Press.—John More, New York city.
106,392.—Steam Generator. D. A. Morris, New York city.
106,393.—Box.—John Nelson, Rockford, Ill.
106,394.—Self-Closing Compression Faucet.—Edward Noble, North Haven, Conn.
106,395.—Fanning Mill.—Harrison Ogborn, Richmond, assignor to Samuel Watson, Lewisville, Ind.
106,396.—Piano Action.—C. F. Oliver, Lynn, assignor to Nathaniel Cummings, Boston, Mass.
106,397.—Ground Pulverizer.—E. A. Olleman, Mooresville, Ind.
106,398.—Hand Stamp.—W. E. Osborn, Brooklyn, N. Y.
106,399.—Car Coupling.—W. R. Patton (assignor for one-half his right to Denison Tisdale), Des Moines, Iowa.
106,400.—Governor for Steam Engine.—A. J. Pevey (assignor for three-fourths of his right to G. F. Pottle), Boston, Mass.
106,401.—Refrigerator.—Eliab Perkins, Fond du Lac, Wis.
106,402.—Box for Bluing, etc.—A. F. Pickens, New York city.
106,403.—School Desk.—J. F. Piehl, Richmond, Ind.
106,404.—Lathe.—P. H. Pitts, Waverly, Mo.
106,405.—Ramrod Stop.—S. W. Porter, Springfield, Mass.
106,406.—Wagon Brake.—Asahel Quimby, Salem, Mass.
106,407.—Coffee Mill.—F. C. Richer, Gilmer, Texas.
106,408.—Portable Iron Derrick.—Samuel Rider (assignor to himself, S. R. Griffith, and A. W. Cox), Oil City, Pa.
106,409.—Pouncing Machine.—John Rosenkranz, Boston, Mass.
106,410.—Stove Pipe Damper.—W. F. Rossman, Hudson, N. Y.
106,411.—Farm Gate.—C. W. Saladee, St. Catharines, Canada.
106,412.—Railway Car Brake.—E. W. Sandford, Brooklyn, N. Y.
106,413.—Parlor Grindstone.—J. M. Simpson, Oshkosh, Wis.
106,414.—Washer and Boiler.—John Slater, Norwich, N. Y.
106,415.—Tatting Shuttle.—C. H. Smith, Brooklyn, N. Y. assignor to himself and T. D. Day, Bergen Point, N. J.
106,416.—Curtain Fixture.—R. I. Smith, deceased, Wolcottville, Conn.; Elisha Turner, executor.
106,417.—Cotton and Hay Press.—W. M. Smith, Augusta, Ga.
106,418.—Electro-Magnet.—W. W. Smith, Cincinnati, Ohio.
106,419.—Machine for Making Chain-Links.—J. H. Snyder, Troy, N. Y.
106,420.—Slide Chuck for Lathes.—C. F. Stackpole, Woburn, Mass.
106,421.—Cutter-Head for Planing Machine.—Darius Stevens, Danbury, Conn.
106,422.—Diaper Pin.—I. W. Stewart, New York city.
106,423.—Railway Switch.—J. H. Stockton, Thompson, Ga.
106,424.—Water Pipe Machine.—J. W. Stockwell, Portland, Maine.
106,425.—Barbers' Furniture.—Otto Stoelker, Montgomery, Ala.
106,426.—Clasp for Lightning Rods.—Richard Street, Albany, N. Y.
106,427.—Press for Hay, Cotton, etc.—G. W. Swinebroad, Bolivar, Tenn.
106,428.—Beverage, or "Champagne Mead."—A. S. Taylor, San Francisco, Cal.
106,429.—Gear for Carpet-Sweeping Machines.—G. F Taylor, New York city.
106,430.—Dredge Box.—A. F. Tripp, Buffalo, N. Y.
106,431.—Saw-Filing Machine.—William Tucker, Fiskedale, Mass., assignor to himself and P. A. Snell, Pittsburg, Pa.
106,432.—Reversible Center Pinion for Watches.—Alson Twing, Waltham, Mass.
106,433.—Pump.—Henry Van Keuren, Jersey City, N. J.
106,434.—Railway.—Horace S. Weaver, Freeport, Pa.
106,435.—Base-Burning Stove.—A. G. Webster (assignor to himself and G. T. Scudder), Troy, N. Y.
106,436.—Corn Husker.—Dwight F. Welsh, Bucyrus, Ohio
106,437.—Vine Cutter and Trimmer.—H. W. White, Joppa Village, Mass.
106,438.—Saw-Jack.—Abel Whitlock, Danbury, Conn.
106,439.—Machinery for Working Hides, Scouring Leather, etc.—T. R. Williams, Salem, assignor to Chester Guild, Jr., Boston, Mass.
106,440.—Press for Bailing Broom Corn.—W. J. Wilson, Coles county, Ill. Antedated July 30, 1870.
106,441.—Rotary Steam Plow.—J. T. Wilson, Rochester, N. Y.
106,442.—Stove or Furnace Grate.—G. A. Wing, Albany, N. Y.
106,443.—Ditching Plow.—Stephen Sidney Wood, Brooklyn, N. Y.
106,444.—Hay Spreader.—Gilbert I. Wooster, Plymouth, Conn.
106,445.—Portable Bath Seat.—Allen P. Young (assignor for one half his right to Albert H. Spencer), Providence, R. I.
106,446.—Quilting-Frame Holder.—Nicholas Young, Parma, Mich.
106,447.—Wood Pavement.—Andy M. Adams, Washington, D. C.
106,448.—Manufacture of Glue.—William Adamson, Philadelphia, Pa.
106,449.—Manufacture of Wheels.—E. A. Archibald, Methuen, Mass.
106,450.—Manufacture of Pocket-Books.—James C. Arms, Northampton, Mass.
106,451.—Manufacturing Envelopes.—James Ball, New York city, assignor to himself and Samuel Raynor & Co.
106,452.—Ejector and Steam Condenser.—Andrew Barclay, Kilmarnock, North Britain.
106,453.—Churn Dasher.—Henry F. Bartlett, La Grange, Mo.
106,454.—Automatic Lubricating Sleeve.—S. R. Bartlett, Chicago, Ill.
106,455.—Fence.—William Bartlett, Little Hocking, Ohio.
106,456.—Mode of Attaching Sleigh-Bells to Straps.—W. E. Barton, East Hampton, Conn.
106,457.—Cooking Apparatus.—Henry C. Berry, Wauseon, Ohio.
106,458.—Machine for Cutting off Shafts and Pipes and for Cutting Screw Threads.—George Blake, Whitby, Canada.
106,459.—Last for Machine-Sewed Turned Shoes.—L. R. Blake, Boston, Mass.
106,460.—Dining Table.—Minor P. Boyd, Unionville, S. C.
106,461.—Toy Toad.—G. E. Bringman, Baltimore, Md.
106,462.—Bread Toaster.—Heman P. Brooks, Waterbury, Conn.
106,463.—Dentists' Chair.—William M. Butler, Louisville, Ky.
106,464.—Combined Shovel and Dungfork.—Jesse Carpenter, Niconza, Ind.
106,465.—Preservation of Meat and other Articles of Food.—Ferdinand Cassel, Cologne, Prussia.
106,466.—Machine for Spinning Flax, Hemp, etc.—H. A Chapin, Bridgeport, Conn., assignor to William Sparks Thomson, New York.
106,467.—Wrench.—Sylvanus Chapman, Charlestown, Mass.
106,468.—Block for Carpet Printing.—Thomas Crossly, Bridgeport, Conn.
106,469.—Axle Box.—David Dalzell, South Egremont, Mass.
106,470.—Axle for Vehicles.—David Dalzell, South Egremont, Mass.
106,471.—Railway Car Coupling.—Jonathan L. Devol and Atwell L. Peadro, Parkersburg, West Va. Antedated August 4, 1870.
106,472.—Permutation Lock.—Charles Diebold and Jacob Obernesser (assignors to Chas. Diebold and Jacob Kienzle), Cincinnati, Ohio.
106,473.—Vegetable Knife.—Fred. Durand and Wm. F. Gilbert, Derby, Conn.
106,474.—Medical Compound for the Cure of Gravel.—T. G. Elswald, Providence, R. I.
106,475.—Wrench.—Henry Fessler and Robert V. Jones (assignors to themselves and J. D. Graben, Canton, Ohio.
106,476.—Brush for Cleaning Tumblers.—Adolph Fischer, New York city.
106,477.—Loom for Weaving Rattan.—S. L. Fitts (assignor to G. C. Winchester), Ashburnham, Mass.
106,478.—Cultivator.—Julius Gerber, Rockford, Ill.
106,479.—Composition to be used in Dyeing.—Franz Graupner, Evansville, Ind.
106,480.—Railway Switch.—James T. Guthrie and Louis Pausch, Leesburg, Ohio.
106,481.—Ruffling Attachment for Sewing Machines.—H. M. Hall, New York city.
106,482.—Stalk and Kindling-Wood Cutter.—George B. Hanalin, Williamantic, Conn.
106,483.—Horse Power.—George B. Hamlin, Williamantic, Conn.
106,484.—Fruit Dryer.—Henry Henley, Shoals, Ind. Antedated August 4, 1870.
106,485.—Hoisting Jack.—Frank Hollenberry (assignor to himself and John C. Frizzell), Frizzellburg, Md.
106,486.—Journal Box.—John Hughes, New Berne, N. C.
106,487.—Coupling for Wire Rigging.—Wm. C. Ireland, Boston, Mass.
106,488.—Shoe.—Joseph L. Joyce, New Haven, Conn.
106,489.—Hemming and Felling Device for Sewing Machines.—Jacob Karr, Washington, D. C.
106,490.—Brick Machine.—John Keller, Paduca, Ky.
106,491.—Centrifugal Sugar-draining Machine.—Hugh W. Lafferty and Robert Lafferty, Gloucester, N. J. Antedated August 5, 1870.
106,492.—Washing Machine.—John L. Larose, Leavenworth, Kansas.
106,493.—Electro-magnetic Motor.—L. T. Lindsey, Jackson, Tenn.
106,494.—Combination of Label-holder and Handle.—Henry Manneck, New York city.
106,495.—Spring for Piston Packing.—David Maydole, Norwich, N. Y.
106,496.—Handle for Casket.—Alexander McGuire, Winchester, Conn.
106,497.—Steam Engine.—Hermann Mohr, New York city.
106,498.—Flexible Shaft.—James B. Morrison, St. Louis, Mo.
106,499.—Knitting Machine.—Edward Morse, Winchendon, Mass., assignor to Hinkley Knitting Machine Co.
106,500.—Seeder and Fertilizer Combined.—W. B. Myers, Hampton, Pa.
106,501.—Nail.—Andrew Patterson (assignor to John Dean), Worcester, Mass.
106,502.—Fire Grate.—Merritt Peckham, Utica, N. Y.
106,503.—Base-burning Stove.—Merritt Peckham, Utica, N. Y.
106,504.—Tobacco Box or Drum.—John Potter, Quincy, Ill.
106,505.—Horse-power.—Tapley B. Pyron, Springfield, Mo.
106,506.—Dripping Pan.—Adam Reid, Buffalo, N. Y.
106,507.—Sheave Block.—T. H. Rice, Baltimore, Md.
106,508.—Manufacture of Truss Pads.—S. S. Ritter, Philadelphia, Pa. Antedated August 10, 1870.
106,509.—Ironing Table.—J. H. Ruff, Thomas Run Post-office, Md.
106,510.—Grindstone Journal Box.—J. B. Sargent, New Haven, Conn.
106,511.—Mortising Machine.—G. T. Savary, Newburyport, Mass.
106,512.—Propelling Apparatus.—Cornelius Schilling, New York city.
106,513.—Harvester Rake.—Jacobs W. Schuckers, Philadelphia, Pa.
106,514.—Towing Hook for Canal Boats.—L. R. Shipman, Bloomsburg, Pa.
106,515.—Spark Arrester.—Jas. Smith, Altoona, Pa.
106,516.—Wash Boiler.—Oscar F. Stedman, Westfield, N. Y.
106,517.—Fire Extinguisher.—Thomas Tripp, Chicago, Ill.
106,518.—Compound for Extinguishing Fire.—W. P. Van Deursen, Cincinnati, Ohio.
106,519.—Combined Latch and Lock for Gates.—H. R. Van Eps, Peoria, Ill.
106,520.—Vegetable Cutter.—Franz Wagner, New York city.
106,521.—Stove Grate.—R. Ward, Edinburgh, Ind.
106,522.—Vapor Burner.—Thomas Ward, Columbus, Ohio.
106,523.—Motive Power.—William Medd Watson, Tonica, Ill.
106,524.—Sadiron.—William Webster, Washington, D. C.
106,525.—Steam Water Elevator.—H. M. Wightman, Boston, Mass.
106,526.—Thread Cutter for Sewing Machines.—C. J. Wood, Brewerton, N. Y.
106,527.—Water-pipe Support.—C. D. Wo druff, Toledo, Ohio.
106,528.—Ventilator for Stovepipes.—C. D. Woodruff, Toledo, Ohio.
106,529.—Velocipede.—Chas. Wyndham, Southover Grange, near Lewes, England.
106,530.—Apparatus for Rectifying Alcoholic Liquors.—C. L. Fleischmann, Cincinnati, Ohio.

REISSUES.

4,098.—Stovepipe Thimble.—T. K. Anderson, Hornellsville, N. Y.—Patent No. 41,592, dated Feb. 16, 1864.
4,099.—Machine for Husking Corn.—L. A. Aspinwall, Albany, N. Y.—Patent No. 101,866, dated April 12, 1870.
4,100.—Capstan and Windlasses.—David N. B. Coffin, Jr., Newton, and Benjamin Woodward Somerville, Mass., assignees, by mesne assignments, of David N. B. Coffin, Jr.—Patent No. 59,369, dated Nov 27, 1866.
4,10 .—Saw Mill.—Alexander McCreight, Tranquility, O.—Patent No. 82,979, dated Oct. 13, 1868.
4,102.—Chills for Casting Car Wheels.—Wm. Wilmington, Toledo, Ohio.—Patent No. 85,046, dated December 15, 1868.

DESIGNS.

4,293.—Journal Box.—P. P. Child, St. Louis, Mo.
4,294.—Carpet Pattern.—John Dornan, Philadelphia, Pa.
4,295.—Shade for Gas or Lamp Burner.—John Letchworth (assignor to Hartell & Letchworth), Philadelphia, Pa.
4,296.—Hand Stamp.—J. F. Pages, San Francisco, Cal.
4,297.—Table Caster.—Daniel Sherwood and G. D. Dudley, Lowell, Mass.

NEW BOOKS AND PUBLICATIONS.

The Sunburst

Is the title of a new literary journal, edited by our talented young friend William F. McNamara. Its design is to furnish a journal of entertainment and instruction to Irish families—something elevating in its tendencies and teachings. The first number is a good one. It goes in for temperance, and eschews politics.

APPLICATIONS FOR THE EXTENSION OF PATENTS.

Melodeon.—El Dora Louis, New York city, has petitioned for an extension of the above patent. Day of hearing Nov. 2, 1870.

Adjustable Seat for Carriages.—George Cook and David Cook, New Haven, Conn., has applied for an extension of the above patent. Day of hearing Jan. 18, 1871.

Inventions Patented in England by Americans.

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

PROVISIONAL PROTECTION FOR SIX MONTHS.

1,987.—Apparatus for Reducing Wood, Metal, and other Hard Material to Fixed Patterns.—F. Baldwin, West Brattleboro, Vt. July 14, 1870.

1,988.—Counting Registers.—W. H. McNary, Brooklyn, N. Y. July 14, 1870.

1,990.—Spool Machine.—J. F. C. Rider, ——, N. H., and E. P. Brownell ——, R. I. July 14, 1870.

2,000.—Machinery for Molding Clay, etc., into Drain Pipes and other Articles.—P. S. Justice, Philadelphia Pa. July 15, 1870.

2,030.—Roadways, etc.—H. Hughes, San Francisco, California. July 15, 1870.

2,050.—Basters for Sewing Machines.—F. T. Grimes, Liberty, Mo. July 20, 1870.

2,052.—Ovens.—Hosea Ball, New York city. July 20, 1870.

2,055.—Railway Carriage Wheels.—A. F. Cooper, San Francisco, Cal. July 21, 1870.

2,097.—Canopies.—A. M. Rodgers, Brooklyn, N. Y. July 26, 1870.

2,101.—Manufacturing and Molding Solid Collodion.—J. S. Hyatt and J. W. Hyatt, Albany, N. Y. July 26, 1870.

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PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent, even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are hundreds of others who have realized large sums—from fifty to one hundred thousand dollars—and a multitude who have made smaller sums, ranging from twenty-five thousand to fifty thousand dollars, from their patents. The first thing requisite for an inventor to know is, if his invention is patentable. The best way to obtain this information, is either to prepare a sketch and description of the invention, or construct a model, and send to a reliable and experienced patent solicitor, and ask advice.

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Proposals & Tent Poles

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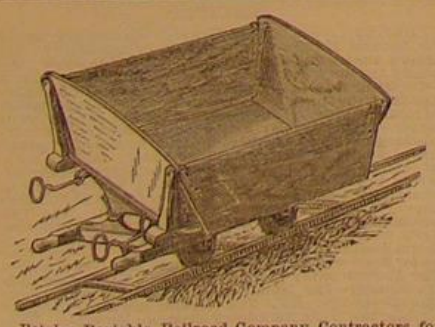

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NOTICE
RELATING TO ARTIFICIAL LIMBS.
WAR DEPARTMENT, SURGEON GENERAL'S OFFICE, Washington, 15th July, 1870.

Congress having provided by Acts approved June 17 June 30, and July 11, 1870, for the reissue every five years of Artificial Limbs, or the value thereof in money, to officers, soldiers, seamen, and marines, who have lost limbs in the service of the United States, the following instructions are published for the benefit of those interested:
Applications should be made direct to the Surgeon General, from whose office the necessary blanks will be furnished on request.
Upon applications for limbs in kind, orders will be given by the Surgeon General, upon any manufacturer selected, who shall first have filed a bond in the sum of Five Thousand Dollars, with two sureties, to furnish good and satisfactory limbs, without extra charge to the soldier, and make good all defects of material or workmanship without additional charge, subject in all cases to the inspection of such persons as the Surgeon General may designate.
Blank forms of bonds will be furnished by this Office.
Transportation to and from the place of fitting the limb will also be furnished upon a written request addressed to the Surgeon General.
Applications for commutation will be certified by the Surgeon General, and transmitted to the Commissioner of Pensions for payment, through the local pension agents.
As full instructions will be forwarded from this Office, with the blank form of application, the expense of employing an Attorney or Agent will be in no case necessary.
J. K. BARNES,
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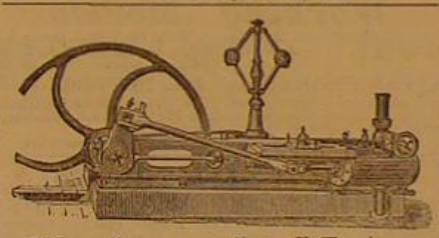

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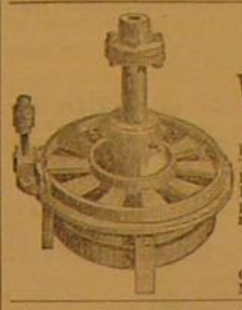

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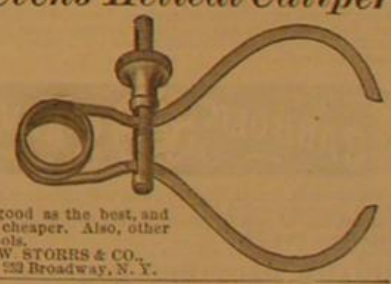

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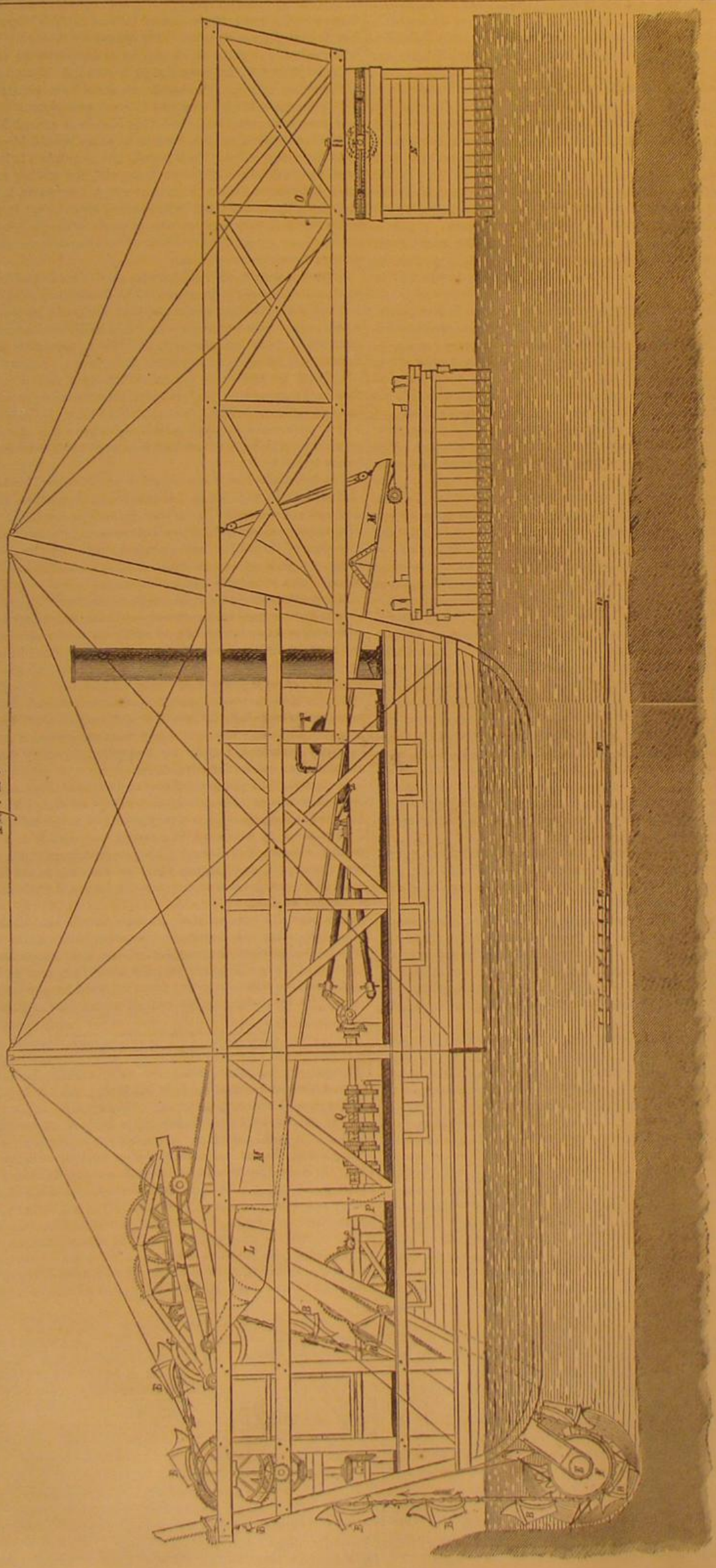


Fig. 1.

D. S. HOWARD'S IMPROVED DREDGING MACHINE.

Improved Dredging Machine.

The inventor of this machine, Mr. D. S. Howard, C. E., of Richmond, Va., after long experience in constructing dredging machines adapted to the various characters of materials to be excavated, and the different circumstances under which such machines are necessarily employed, has been led to the invention of the machine illustrated in the accompanying engravings, and which he claims is adapted to a much wider range of circumstances and situations than the machines heretofore employed.

He also informs us that the improvements in the materials and the construction of the machine render it so much more desirable, that its use has been advantageously extended beyond the immediate purposes for which it was originally constructed.

Fig. 1 is a side view of the machine which is designed to deposit in lighters over the stern or at the sides, as occasion may require. The machine is also constructed to work with any shaped bucket best adapted to the material to be excavated. Fig. 2 (see page 150) is an end view, showing the facilities for lateral deposit. In these engravings similar letters refer to the same parts.

The several parts, and their use in the general operation of the machine, are thus described by Mr. Howard:

A is the driving chain wheel, geared to the engine by wheels and shafting. The buckets, B, are attached to the chain, as shown in both figures.

C represents the center cylinders, with the spiral scrapers and hooks, for loosening and conveying the material to be excavated, from the center, each way, to the buckets.

D, in Fig. 2, represents short cylinders on the ends of the cylinder shaft, E, Fig. 1, with spiral scrapers for conveying the material to be excavated, from the outside to the buckets.

The short cylinder on the port side of the dredge, Fig. 1, is left off, to show the lower chain wheels and the lower attachments to the ways.

F is one of the lower chain wheels, attached to the cylinders and driven by the chains, in the same manner as the chains are driven by the driving chain-wheel, A, by cams fitting into alternate links of the chain.

G is one of the flange wheels seen in Fig. 1, over which the chain passes before descending to the lower chain wheels, F.

H is one of the movable frames, which suspends the flange wheels, G, on rollers running upon ascending ways, provided with powerful purchase wheels, terminating in a pinion working in a descending rack, shown in Fig. 1.

This purchase is worked by a cog wheel on the flange-wheel shaft (not shown in the drawing), working in a wallower wheel when thrown into gear, for the purpose of raising the buckets from the bottom when required, by forcing the flange wheels, G, up the inclined ways. When the machine is not in motion, the wallower wheel may be thrown out of gear, and worked by hand, with a long double crank, K, Fig. 2.

By the motion of the buckets in the direction of the arrows, the excavated material is brought up, and if it is to be deposited over the stern, it is dumped into the movable spout, L, Fig 1, which is attached to the axis of the flange wheel, G, by the extension of its sides, and moves freely within the stationary spout, M, allowing the flange wheel, G, to be drawn up, when necessary, with the movable frame, H, without changing its proper position, for receiving the contents of the buckets as they pass over the flange wheel, G.

N, Fig. 1, is the counter balance, situated about 25 feet aft of the hull, attached to it by a truss frame and hog chains, for the purpose of balancing the weight of machinery necessarily placed ahead of the hull, to enable the dredge to clear its own way. It is also used for transferring the lighters, by attaching the empty one to the outside of the counter balance, and the loaded one to the inside; then by the lever, O, which works the geared rollers between the counter balance and the truss frame, the two lighters are changed about, the empty one inside, under the spout, M, ready to be filled, and the loaded one outside, ready to be transferred to the dumping place. It is also used as a water tank for the engine, which may be filled in the morning, before the water has been disturbed by the dredging, sufficiently to afford clean water during the day.

B, Fig. 3, is a perspective view of a bucket used in this arrangement for depositing over the stern. It is provided with a loose bottom, which drops with the load about two inches, rendering the discharge perfectly certain when at work in the worst kind of material.

When the situation of the work is such as to require the deposit to be made on the bank, or into the lighters alongside, a bucket, like B, Fig. 4, is put on the chain, in place of B, Fig. 3, which dumps into the lateral spouts, situated between the driving chain wheel, A, and the flange wheel, G, by the tripping of the latch which lets fall the whole underside of the bucket, hinged to the bolt that fastens the bucket

[CONTINUED ON PAGE 150.]

ON STEAM BOILER INSPECTION.

BY MR. E. D. MARTEN.

[Read before the Institution of Engineers in Scotland, May 31, 1870.]

Steam boilers are now so common, and so often seen working with apparent safety on steamboats or railways or in manufactories that familiarity is apt to breed contempt for the danger that surrounds them if they should be faulty or used without due care.

The wreck produced by the explosion of a steam boiler is often so extensive that the casual observer is easily persuaded that there must have been some sudden accession of power at the moment of explosion, and is readily made to believe in mysterious theories involving intricate suppositions as to the influence of electricity, the spheroidal condition of water in contact with hot plates, the decomposition of water and ignition of the gases, the sudden generation of steam from water heated to a high temperature, and a host of other phenomena which are themselves true and perfectly understood, but have little or nothing to do with boiler explosions.

A very simple calculation will enable any one to realize that there is plenty of force accumulated in an ordinary boiler to account for all the mischief, if it is liberated suddenly. A boiler of an average size contains when at work sufficient accumulated "force," in the shape of steam and heated water, to work a thirty-horse engine for about ten minutes without additional firing; and if this should be liberated *in one second* by the rupture of the boiler, the power to cause explosion is equal to the united effort of 18,000 horses. A boiler forms a reservoir of power, and, like a reservoir of water, is capable of producing much useful work if allowed to flow gradually through a proper mill or engine, but capable of vast destruction should the rupture of the sides allow the contents to escape suddenly.

It has been calculated that the explosive effect of each cubic foot of water in a boiler at sixty lbs. pressure is equal to the detonation of one pound of gunpowder; so that in the case before given there would be the same effect as from the explosion of about 500 lbs. of gunpowder.

The explosions of vessels containing high pressure steam, but not exposed to any fire which would render possible any overheating or decomposition of steam, etc., cause as much havoc as the bursting of ordinary boilers when the contents are suddenly liberated by rupture of the sides.

It has long been the object of engineers who have given especial attention to this subject to obtain accurate records of every case of boiler explosion, and I have done my utmost to assist in that object, and have obtained notice of more than 1,500 explosions, causing the death of over 5,000 persons, and the injury of some 4,000 others.

The records are discouraging in many respects, as they contain the names of some of the best and most careful engineering firms as owners of exploded boilers, and also give instances of explosion of nearly every form of boiler which has been in use for any length of time; for there are plenty of exploded locomotives, Cornish, Lancashire, and other boilers, once held to be almost incapable of explosion, as well as the more old-fashioned Balloon, Haystack, Butterley, or plain cylinder boilers.

In but few of the earlier explosions are trustworthy records obtainable; but for some ten or twelve years they have been far more complete and accurate, and their careful consideration has led to the conclusion that most of the explosions could have been prevented had the actual condition of the boilers been known.

Nearly all who have given special attention to the matter being agreed that most explosions could be prevented if the conditions of the boilers were known, the problem suggests itself—how are owners to keep themselves informed of the condition of their boilers; and the simple answer is, by periodical inspection.

Inspection may be done by any one, and its value will differ according to the care and intelligence of the inspector.

It may be well to describe what is usually meant by boiler inspection. To insure due attention a written report should be made, which must be perfectly intelligible to any one who has not seen the boiler, and to prevent confusion no two boilers should be mentioned on one paper, and the report should be made complete at once, so as not to need fair copying, and illustrated with sketches. In the first place, every particular of boiler and fittings and setting should be noted that can be seen from the outside of the boiler, with sketches and sufficient dimensions to make complete detailed drawings if required.

The boiler should then be entered, and internal sketch and dimensions taken sufficient to make a complete drawing. The plates should then be felt in every part with a light hammer, and the general condition noted.

The flues should be reserved for the last, because they are generally dirty, but this is often the most important part of the inspection. The fire grate and each flue should be entered and traversed, and every part of the boiler plates felt with a hammer, and also dimensions taken as before.

This is not all that is necessary to obtain complete information, for there still remain those parts of the boiler in contact with the brickwork, and the neglect of which often leads to disaster. It is easy to clear the brickwork sufficiently for examination, but a little arrangement when setting the boilers would make it far easier, and will be again alluded to.

It may be well to mention the chief impediments to carrying out this inspection. It is often impossible to make even the external examination, because boilers are so smothered up with brick and stonework. The clothing of boilers is often justly urged as leading to economy of fuel, but it should not be done in such a way as to preclude examination. The most rapid corrosion goes on if a leak should take place beneath the covering, especially if it consists partly of sand or ashes.

Internal examination is sometimes prevented by too small a man-hole, or one so awkwardly placed as to make it almost impossible to twist into the boiler; but the most usual difficulty is the want of room to move about, or to use a hammer. Sometimes also there is no means of cooling sufficiently to remain in the boiler many minutes.

Each form of boiler has its peculiar difficulties. The Cornish or one tube boiler is one of the most awkward, as there is so little space between the tube and shell at the sides and bottom, and a false step may cause the inspector to slip and become wedged. An instance of this occurred last year, where the plates of a boiler had to be cut out to extricate a man.

The Lancashire or two tube boiler obviates this difficulty, but involves another man-hole to get at the space beneath the tubes.

Most of the multitubular boilers, such as the locomotives, are too small to enter, and the impossibility of internal examination has led to many explosions.

Of course the difficulty of examination is much increased if the scale is not well cleaned off, as without this many a fault will be overlooked.

The easiest boilers to examine internally are the plain cylinders, or others without internal tubes, and this facility for examination is one of their chief recommendations.

The upright boilers, such as work from the waste gases from iron furnaces, are particularly easy to examine, as there is plenty of room to stand upright both inside and in the flues.

The flue examination is attended with some impediments, as in most boiler settings facility for entrance to the flues appears to have been the last consideration. In many cases entrance is simply impossible, as the brickwork is only a few inches from the boiler. In not a few cases the man-holes are little cast-iron frames and doors, and too small for even a lad to pass through. Even when the flues of the Cornish and Lancashire boilers are large enough to pass along, the narrow space and inclined or crawling position are awkward. The plain flash flues of the externally fired boilers are easiest to examine.

The value of the examination when all the above impediments are overcome must depend on the knowledge of the inspector as to the points to observe, and as to what mischief to be on the look out for. Of course it is presumed that the boiler when fixed was a good one; the object of inspection being to ascertain whether it has become weak or dangerous while working.

It is often found that boilers have been injudiciously altered in form. In one case the tube had been removed without due care in compensating for the loss of the support of the tube and the extra area exposed to pressure in the flat ends by suitable stays, and, of course, the end was blown out.

Great loss of strength is often caused by injudicious repair, even when there is no intended change in the form of the boiler. Plain cylinder boilers originally constructed in rings with joints crossed, are often found so much repaired with patch upon patch that the seams become nearly continuous from end to end. The strength of such boilers it is impossible to calculate, as the metal must be exposed to unequal strains from the new and more elastic plate not taking up its exact proportion.

The faults visible from the outside of the boiler are generally so apparent when the covering is removed that they can hardly escape detection. The chief danger is from corrosion from the neglect of leaking of joints.

The faults visible from the inside may more easily escape detection. In those boilers which depend upon stays for their strength, the stays need very careful examination to ascertain if there is any sign of weakness. It is not at all uncommon to finds stays of proper and good construction, but with the rivets attaching them to the boiler loose or nearly sheared off.

The effect of internal corrosion is generally easily detected, but there is a form of it called "furrowing" which may escape attention. It is found in Lancashire boilers, sometimes in the angle iron, and sometimes in the plate close to it, and as scale often fills the crevice or "furrow," it may escape notice. The same thing is found in locomotives just by the lap of seams. The furrows are supposed to be caused by the "fatigue" of the metal in certain lines of strain due to the bending backwards and forwards of the end of the boilers to accommodate itself to the varying lengths of the tubes and shell when expanded or contracted by alternate working and cooling. The same lines of strain are produced in the barrels of locomotives by their efforts to assume the truly circular shape. Not only is the metal in these lines rendered more open in texture and more liable to corrosion, but the scale is continually thrown off, exposing fresh surface. "Furrowing" should never be neglected, as it increases very rapidly when once set in.

The faults to be observed in the flues are numerous, but two or three only will be noticed. When boilers are patched the old metal is often strained and punished by the removal of the old rivets and the "drifting" to pull it up to the new plate. This not unfrequently sets up "seam rips" or cracks from hole to hole, which not only throws extra and ever increasing strain on to the rivets at each end of the "rips," but often produces a jerk which causes such enormously increased strain on each succeeding rivet that the whole seam rips round and allows the boiler to break up.

External corrosion is another most frequent fault visible from the flues. The leakage from a sprung seam will often run down the lap causing a "channel" or narrow line of corrosion. This is often found also in the seams of upright boilers on the upper side of the lap. As the channel is seldom more than one or two inches wide it is easily seen by marked contrast with the sound plate, but when corrosion is more general from dampness in the flues it is not so quickly noticed, as the edge of the upper lap also corrodes, leaving the same apparent thickness at the edge of the plates, whereas, in reality, the lower plate may be eaten more than half way through. The same thing may deceive where a new piece of plate has been inserted on to a thin plate. Very slight corrosion of the already thinned plate may be much more dangerous than would be supposed from anything seen on the outside.

The corrosion which goes on at a point of contact with brickwork is one of the most frequent causes of anxiety to those who have the inspection of boilers, as it is sometimes found when least suspected. It is caused by the damp being held against the plate, and is the more dangerous as it produces weakness in long continued lines in the directions of the greatest strain. The walls are often now constructed with removable bricks, or slight holes at each seam.

It is very frequently asserted that corrosion cannot be the cause of explosion, as the weakened place would blow out and relieve the boiler. This may be the case when it is only local, but when in continuous lines, and the giving way of one point throws the strain on the surrounding parts, it leads to a break up as described in the case of seam rips. In tubular boilers it is very necessary to measure both diameters of the tubes to detect the first signs of weakness from the departure from the true circle.

Some few words are necessary as to the testing of boilers by steam or hydraulic pressure. The former is so dangerous, and has led to so many accidents, that it should be avoided. Attempts to caulk leaking seams while under steam pressure have led to many fatal explosions. Many more fatal explosions would be caused by proving from steam pressure, were it not that makers often deceive themselves and their customers by supposing that a large boiler can be proved by connecting a small inch pipe to another boiler, the gage upon which shows the required pressure; whereas condensation goes on so rapidly that not half the pressure is ever reached in the tested boiler.

The hydraulic test is not attended with danger if all air is excluded from the boiler, but it is found in practice that it does not always detect dangerous furrows or corrosion. It is undoubtedly most useful when applied with judgment during the time of inspection, and should always be considered a necessary part of inspection, but it cannot be relied upon alone or as a substitute for inspection.

Many attempts have been made to construct boilers that should be free from all danger of explosion, by having all the parts exposed to pressure of very small diameter and avoiding the large quantity of steam and water accumulated in ordinary boilers. Such boilers are made of both cast and wrought iron, but the experience with them is short, and for ordinary work the absence of accumulations of power makes it difficult to maintain regularity. In all descriptions of such boilers, however, although absolute safety from explosion is unhesitatingly promised, facility for inspection of every part is mentioned as one of the advantages.

In conclusion, I would submit that periodical inspection is the surest means of securing the safety of steam boilers. Also, that this inspection is a very good and useful safeguard, if only done by the man in charge; but that it is a still greater safeguard if done by independent inspectors, who have the experience of seeing many boilers and are not influenced by the exigencies of the manufacturers, for whom the boiler may be used.

Such was the opinion of those who formed the Midland Boiler Inspection and Assurance Company, under whose auspices I have obtained a great deal of the information as to boiler explosions which I have been enabled to give to the public, and to whose courtesy I am indebted for permitting me to give whatever may be deemed useful in the present paper.

THE ARTISAN IN PRUSSIA.

Compulsory education being the rule in Fatherland, the German artisan has that much in his favor; yet his English brother would not care to change places; low wages and meager diet sadly counterbalancing a little extra culture. $3·00 a week is very good pay in Prussia, as determined from a long list of the rates of weekly wages in that country in 1867. In most cases twelve hours, and in many, thirteen, go to the working day. Women form more than a fifth of the factory operatives, and earn, comparatively, good wages; but public labor brings its too frequent consequences, and the female operatives bear a very indifferent character. As for seamstresses and milliners, those who work for commercial houses are, as usual, most miserably paid; so miserably, indeed, that to live at all they are compelled to eschew morality.

The wages quoted above are said to suffice thrifty men while single, and even leave a margin for saving; but to keep a family upon them, unless the mother as least can contribute something towards the income, is out of the question; and those who know most about the matter do not set the cost of a family at a very extravagant rate. According to official calculations, a man with a wife and three or four children can provide food enough for all at an annual expense of $60·00 if he lives in the province of Prussia; in Posen it would take more than double the amount; while in Pomerania it may be done for a little less. Certainly the Prussian dietary standard is not a very high one, bread, vegetables, butter, and milk being all that is considered necessary; meat, except, perhaps, on holidays and Sundays, coming in the category of luxuries. The daily fare of a workman in the Rhen-

ish provinces is set down as consisting of one pound of rye bread, two pounds of potatoes, an ounce of meat, half an ounce of salt, and one sixth of an ounce of coffee.

Nor can the Prussian be said to be much better off as concerns his lodgment; high rents, confined spaces, little comfort, and less cleanliness being the rule throughout the kingdom. In the large towns, with very rare exceptions, artisans live in lodgings; several families herd together—sometimes as many as fifteen individuals crowding into one small, low, damp room—twenty-five cents a week a head being the Berlin tariff for sleeping accommodation and convenience for washing. Three years since the returns showed there were in the capital 15,574 dwellings with an average of six to seven occupants per room. In the country and in the small towns—unless lodgings are provided by the employer—working folks generally have a house of their own: a house, such as it is. In Memel it will be a mere mud cabin with nailed up windows; in Silesia, a one-storied thatched house, with diminutive windows, and rooms just high enough to allow the proprietors to stand upright in them. The miners of the circle of Ottweiler, in the Rhine province, are perhaps the best off in this respect, being looked after by the government itself. "The three royal coal mines of Heinitz have three large sleeping houses belonging to them to accommodate 800 men. The Rheden mine has two of these for the accommodation of 400 men. The miners pay thirty-six cents a month, for which they have a bed and towels, and the use of half a press. To enable miners to settle in the neighborhood, the Miners' Union has purchased 1,350 acres of land for founding a mining colony. It sells at cost price, or leases at a moderate rent, one sixth of an acre of land to any one who will build a house upon it, and one sixth of an acre upon the same terms for a garden. Money for building purposes is also advanced at four per cent interest, to be deducted from the wages, with a present of from 100 to 120 dollars as a premium for building." These houses at Ottweiler are, as might be expected, neat and cheerful; but, with the exception of them, the description "bad, small, and densely crowded" applies generally to the habitations of the Prussian workman, in whatever part of the land he may be domiciled.

A better condition of things might be looked for where such pains are taken to render the laborer worthy of his hire. Primary education is obligatory for all children from the age of six to that of fourteen, and afterwards the journeyman or apprentice may continue educating himself at the "Fortbildungsschulen," open Sundays, and occasionally upon week days, for a somewhat higher degree of instruction. When a Prussian lad has received the education prescribed by law, he chooses his trade, and binds himself to a master, who, for his labor, gives him board, lodging, and instruction. Apprenticeship seldom lasts more than three years, at the end of which time the young workman gets a certificate from his master, and sets out upon his travels—"wandering," as it is called, being reckoned necessary ere he can claim admittance into the ranks of journeymen. He usually makes a point of visiting the places specially famed for excellence in his branch of trade. If he be a stone-cutter, he must not miss Munich and Cologne; if a locksmith, Berlin and Vienna; if a tailor, Dresden must become his residence for a while; if no one wants his services at any town he enters, the Journeyman's Fund there supplies him with the means of taking him elsewhere. The more ambitious artisans are not satisfied with tramping through Germany, but betake themselves to foreign lands, where not a few of them are tempted to remain—and no wonder! Traveling about the world with open eyes cannot but do the travelers good, and the practice is therefore to be commanded; it is, however, doomed; the new Industrial Code of the North German Confederation has pronounced against it, by declaring wandering no longer compulsory, and that traveling handicraftsmen have no claim for assistance upon their associates in the trade. The Code only came into operation in October, 1869, so that what effect its provisions will have cannot yet be seen. By it a variety of restrictions upon the freedom of industry were swept away; all engagements between man and master are declared to be matters for mutual agreement, to be canceled by a fortnight's notice on either side; and the old prohibitions against workmen uniting, for the purpose of obtaining more favorable wages and conditions of work, more especially by means of strikes, are repealed. But, at the same time, "any one inducing, or seeking to induce, others, by physical force, threats, or outrages, or by placing them under an interdict, to take part in these coalitions," was made punishable by three months' imprisonment. Nevertheless, in Prussia, as elsewhere, labor and capital are continually wasting their resources in trying each other's strength and obstinacy.—*Chambers' Journal.*

THE APPLICATION OF PHOTOGRAPHY TO MILITARY PURPOSES.

Modern warfare may, in many respects be considered as so many applications of science. Not only is war *matériel* designed and manufactured now-a-days upon the most approved data, and according to theories worked out with mathematical accuracy, but a large section of our soldiers are educated in such a manner as fully to appreciate the value of their resources, and so to overcome difficulties which years ago would have been regarded as impossibilities. No instance demonstrates this more satisfactorily than the recent Abyssinian expedition, which, whatever may be said of it as a campaign, cannot but be regarded as one of the most wonderful feats of engineering accomplished in modern times. The nearer warfare approaches perfection, the more decisive, and therefore less cruel it necessarily becomes, as witness the brief duration of the wars of late years on the Continent; and for this reason the improvements in warfare effected by science cannot by any means be regarded as a misapplication of knowledge.

Our present remarks bear reference to the applications made of a very modest branch of science, if science, indeed, it can be called, our object being to demonstrate the many uses made by the War Department of photography. In the special application of this art-science to military matters, our Government is certainly in advance of others, if we except, perhaps, that of France. No less than three establishments have been organized in connection with the army in which photography is extensively practiced, the most important of them being the General Establishment at Woolwich; but, besides these, there are again many Royal Engineer stations, both at home and abroad, which are furnished with photographic requisites and employ the camera for divers purposes. At Chatham, the photographic establishment assumes the character of a school of instruction, at Southampton it forms an adjunct to the Ordnance Survey Office, while at Woolwich, of which department we desire more particularly to speak, the duties performed by all of the camera are as various as they are numerous. For registering patterns, recording experimental results, imparting military instruction, and for other purposes too multifarious to enumerate, photography is extensively used, the faithful accuracy of sun pictures, as likewise the facility with which they are produced, causing the art to be eagerly employed in any way where it can be made available.

As an example of the value of photography in instruction, we would cite an interesting series of pictures taken to illustrate ordnance drill. This series comprises upwards of one hundred views, and demonstrates the practical working of the various kind of guns, mortars, rockets, etc., in the service. One picture, for instance, will illustrate the command, "Prepare for action;" a gun will be shown surrounded by a group of artillerymen in the positions they have been instructed to occupy on the issue of that order, each man having his respective number attached to his cap as a distinguishing mark. The next illustration in the series is probably that of "Load," and the next again "Fire," both of which will represent the change in position of the men, as one operation succeeds another, and the various duties performed in turn by each gunner or number, for it must be remembered that in gun drill every man is told off to a particular number and intrusted with a separate and distinct duty. Thus, on the promulgation of any new system of drill, or of any modification in the method of working, it is merely necessary for the military authorities to forward pictures of this kind to the different instructors, who cannot fail at once thoroughly to understand the new exercise; and even the rawest recruit who had assigned to him a certain number at a gun, would see at a glance the exact position he is to occupy by a reference to the photographs.

Another not less striking instance of the importance of photography in this connection may be given. At the outset of the Abyssinian campaign it will be remembered that several thousands of pack-saddles were required for transporting war *matériel* into the interior. These pack-saddles were made in and sent direct from England to Annesley Bay, so that the troops coming from Bombay knew nothing of their construction, nor of the method in which they were to be packed. This ignorance in the hurry of affairs would have been of serious consequence (for a military pack-saddle of the present pattern is a somewhat complicated contrivance) had not the authorities at home been fully alive to the subject and foreseen the threatening difficulty. A mule at Woolwich was harnessed and packed, after some experience had been acquired in the matter, in the most suitable and approved manner, and the animal then carefully depicted by the aid of the camera; the disposal of the harness and trappings, and the correct way in which the packages were to be carried, were thus clearly shown in a photograph, numerous copies of which were immediately sent out to Annesley Bay and distributed among the officers of the Quartermaster-General's department.

In recording experimental results photography again fulfills a duty which could not be discharged so rapidly and impartially by any other means. The stone iron-cased shields and armor targets built up of metal plates of different thicknesses, and then fired at by shot and shell of all descriptions, are carefully photographed after each decisive experiment, and a record of indisputable accuracy thus obtained. With a picture before us of a target, constructed to represent the side of an armor-plated vessel, which has been experimented on, we can at once form an accurate estimate of the impression made upon the iron wall by shot of different calibers, while rear and side views of the structure will show plainly the amount of damage which the backing or skin of the shield has suffered. As may be imagined these prints form important illustrations to the written reports made from time to time to the War Office authorities.

The photograping of newly adopted Government patterns, whether in the shape of guns, carriages, wagons, mantelets, tents, etc., is also an important section of the work undertaken at Woolwich, as likewise that of producing pictures relating to army equipment, such, for instance, as demonstrate the setting up of cooking apparatus, disposal of ambulances, refitting of ordnance in the field, etc. There is, moreover, the pursuit of photo-lithography to be mentioned, by means of which designs and sketches are copied and transferred to stone for printing off in the ordinary manner.

The subject of working photography in the field is a matter to which much attention has been given at the general establishment, for it will be readily conceived that the simplest and most effective methods of working, as likewise the different uses to which the camera may be put during warfare are questions of very serious study.

The photographic copies, many thousands of which are annually produced and distributed over all parts of Her Majesty's dominions, are not now printed upon silver paper in the ordinary way, but by the so-called carbon or autotype process, a method which produces prints of an absolutely permanent character. Ordinary silver prints are always liable to become faded and stained after the lapse of a few years, owing to the presence in the paper itself, or in the atmosphere with which it comes in contact, of sulphur compounds which attack the metallic silver composing the image. In the carbon pictures, however, no silver at all is present, the composition of the image being a mineral pigment in combination with an insoluble chromium.

Our description of the General Photographic Establishment at Woolwich has been very brief indeed, but enough has been said to show to what an important extent the art is employed in connection with the War Office; the department which we have described is a branch of the chemical establishment of the War Department, which was first organized in 1854, by Mr. Abel, and has gradually become intimately and indispensably connected with every branch of the military service.—*Nature.*

A Geological Excursion in the Moon.

[Translated for the Maine *Journal of Education* from *Cosmos*].

Under this title Stanislas Meunier recently gave a lecture filled with interesting facts, and pleasantly illustrated by numerous photographic projections by the aid of the Drummond light.

The professor remarked at the opening that it is not wholly certain that there are not on the surface of the earth specimens of lunar rocks, since there is no absolute proof that the meteorites are not ejections from the volcanoes of the moon. He moreover added that one can very profitably study at a distance the geological structure of inaccessible localities.

The moon, which appears to be wholly deprived of all atmosphere and consequently of water, presents two very different kinds of rocks, those which constitute the mountains, and those which constitute the so-called *seas*. The former, from the form which they present, and the analogy of that form with that of terrestrial volcanoes, are evidently volcanic rocks. The others, according to Lecoq, are dry sands or melted rocks.

One may, in some instances, study very closely the structure of mountains, and draw, for example, the analogy of the form of the circles in the moon with that of the circles of granite and porphyry in the earth. Schrotter and Herschel both discovered in various mountains of the moon places where a very fine stratification may be seen.

This study of the mountains of our satellite has led to a comparison with the mountains of the earth, and in some instances very striking analogies have been found, especially at the Puys d'Auvergne, the volcanoes of Teneriffe, Palma, etc.

Finally, the observations of astronomers have furnished a basis upon which Chacornac proposes a theory concerning the geogony of the moon. It comprises three grand periods: 1. The formation of the circles. 2. The extension of the muddy diluvium which constitutes the seas. 3. The formation of the comparatively small craters.

After reviewing the various observations cited to prove the actual activity of the lunar volcanoes, the lecturer adopted the opinion of Beer, Moedler, and Arago that the moon is a *dead star*. He then went on to prove that this inference may also be drawn from that singular appearance upon the surface of the moon to which has been given the name of *grooves*. There are grooves with parallel sides nearly a mile in width, and from ten to one hundred and twenty-five miles in length. About ninety have been counted, and it is very probable that they are still in the process of formation. It was a very long time before any reliable explanation of the grooves was given. We are indebted to Professor Lecoq for it (*Traité de Géologie*). It has been further developed by Saeman, who made it the subject of a special article printed in the *Bulletin de la Société géologique de France*.

According to these geologists the grooves are due to the cracking which is evident on the surface of the moon as a result of the loss of heat. There is no reason to suppose that at a former period the moon had not upon its surface both an atmosphere and water. But the latter penetrating the crust, as it does upon our globe, has been gradually absorbed in proportion as the crust has increased in thickness. All the water had disappeared long before the cooling process had reached the center. The loss of heat continuing, the rocks in solidifying contracted in a way analogous to that which basalt manifests, and the grooves are the result. Into these grooves the atmosphere settled.

Everything indicates that the earth is actually passing through the various states through which the moon has already passed. It is estimated that already one fiftieth of its primitive ocean has been absorbed, and that what remains will have been drunk up when the thickness of the crust shall be one hundred miles. Our whole earth from what is known of it, would easily absorb fifty oceans like ours, so that the water at present upon the earth, being once absorbed and which constitutes only $\frac{1}{2400}$ of its weight, would become absolutely insensible to the most precise chemical analysis.

Then the earth will crack open, as the moon has done, and its atmosphere will settle into the fissures beneath its surface. A long time before this all life will have ceased.

The prediction which the study of the moon allows us to make in regard to our globe will evidently be realized only in a far distant future, for after the experiments of Bischof nine millions of years will be needed for the earth to cool down 15°, a loss almost imperceptible, since the internal heat adds only one thirtieth of a degree to the temperature at the surface. We may go further and apply to the sun everything which has been said of the earth and the moon. Being larger, it will cool less quickly, but the time will nevertheless come, at least everything seems to indicate it, when it will have absorbed its waters and its atmosphere, and the fissures will be formed upon its surface. Our whole solar system will then be only an assemblage of dead worlds.

Improved Steam Generator and Water Heater.

This boiler is formed in sections secured together by means of flanges or ears and bolts, with packed joints, the sections being provided with fire flues, water and steam passages, furnace, and fuel magazine; the whole being designed to extend the principle of base-burning—so successfully applied to stoves—to the furnaces of steam boilers.

The number of sections is immaterial as regards the general principle of the device, this number being varied according to the required size and capacity of the boiler.

Fig. 1 is a sectional view of the boiler, which may be used for heating water by steam for domestic use when not required for motive power. It has a door in the dome above the fuel magazine through which the charge of fuel is placed in the furnace. It also has another door giving access to the fire below when necessary in starting, etc., and another still lower opening into the ash-pit. The conical dome or cap receives the smoke and incombustible gases and discharges them into the smoke stack. The boiler may be jacketed, if desired, and is usually so jacketed, but the jacket is omitted in our engraving to show the method of joining the sections.

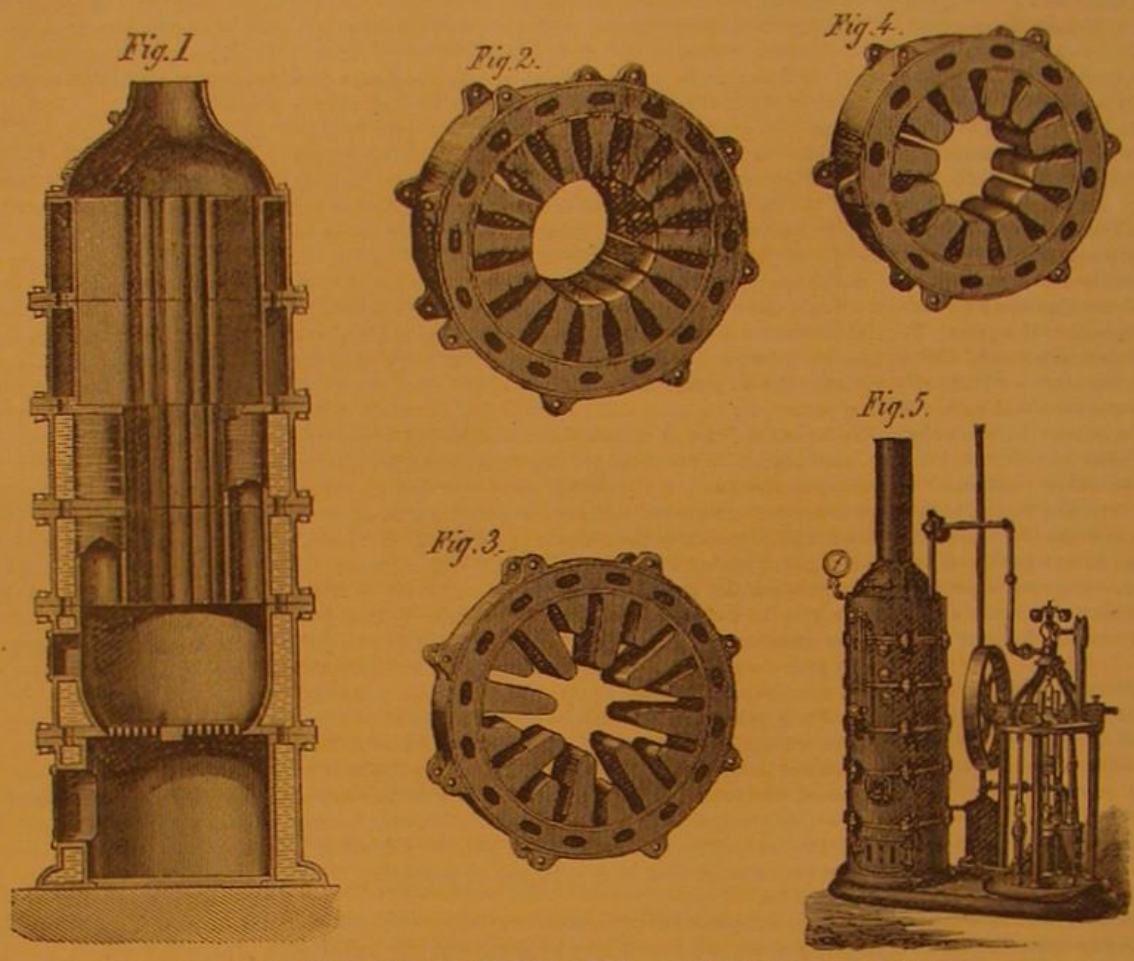
The sections, Figs. 1, 2, and 3, are cast each in a separate piece, with flues, water spaces, and communicating orifices entire. They are then faced up in a lathe and packed with simple elastic packing inserted in grooves in the faces of the sections, which are then bolted together, as shown in Fig. 1. Various forms of the sections are used, as shown in the engravings; but in none of them are the joints exposed to the fire, and the packing is consequently no more exposed than in ordinary steam joints.

Small boilers of this kind may be used advantageously for generating steam for heating purposes, and as great heating surface in proportion to the contained water is obtained by this peculiar construction, they must get up steam very quickly.

Fig. 5 shows the boiler attached to an engine designed by the inventor of the boiler. The boiler and engine are of three-horse power, and stand on a single cast-iron bed plate twenty-six by fifty-seven inches in extent. The boiler is twenty inches in diameter and fifty-four inches high, exclusive of the bed plate and smoke dome. It has thirty square feet of fire surface, and holds about twenty gallons of water when filled to center of gage.

A water heater is constructed on the same plan as the flue section of the boiler, steam being used instead of fire for heating. This engine and boiler give, we are told, three full horse power for one day of ten hours, at an expense of only 100 lbs. of coal. We are further informed that quite a number of the boilers are in use and are giving excellent satisfaction.

This boiler was patented March 22, 1870, by Orlando Clarke, and is manufactured by Messrs. Clarke and Utter, Rockford Iron Works, Rockford, Illinois.



CLARKE'S STEAM GENERATOR AND WATER HEATER.

Improved Universal Shaft Coupling.

The object of this invention is to provide a closed joint, so constructed that it will be as flexible as the old style of universal coupling, but which, at the same time, shall cover all the working parts, so as to obviate the need of boxing, required by law in many of the States to prevent accidents.

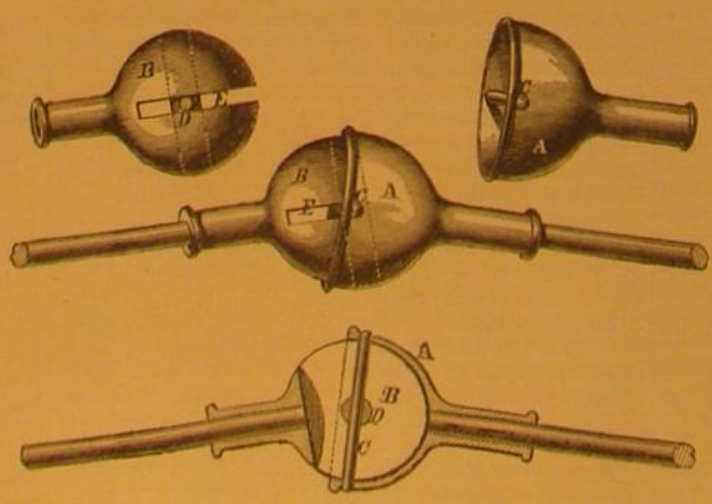
This is accomplished in a simple and ingenious manner readily understood by reference to the accompanying engraving.

A, is a hemispherical shell, taking the place of the old style crutch on its end of the shaft; a spherical shell, B, slotted at E, taking the place of the crutch on the end of the other section of shafting. The spherical shell, B, fits into A, as shown.

A bolt, C, passes across the open end of the shell, A, and through a hole in the middle of a larger bolt, D. The latter bolt reaches out to the sides, but does not penetrate the shell, B, and it cannot be withdrawn from the shell without first removing the smaller bolt, C, which passes through it, as its ends meet and engage with the inner walls of the spherical shell, B. This connects the two sections of shafting, so that they cannot come apart till the bolt C is taken out.

The slot in the shell, B, passes over the bolt, C, which plays therein, and thus a universal motion is obtained, while the parts which are likely to become entangled in clothing or belting, are entirely covered by the shells.

Patented, through the Scientific American Patent Agency, July 26, 1870, by Moses A. Keller, of Littlestown, Pa., whom address for State or shop rights.



KELLER'S IMPROVED SHAFT COUPLING

Soft soap it is said, will soften the hardest putty.

Professor Tyndall on Electrical Phenomena and Theories.

One remarkable peculiarity in these lectures of Professor Tyndall is, the effective way in which several of the more subtile effects of electrical change and power are made manifest to a large audience by the instrumentality of beams of electric light, manipulated in various ways. Thus, for instance, the elongation of a solid bar of iron, when it is thrown into the magnetic state, by being encircled in the folds of a voltaic current, conveyed by a helix, is shown by the starting of a spot of light, some six or eight inches upon a screen, when the molecular condition of magnetism is excited by the passage of the current. A beam of light falls upon a small mirror, carried at the extremities of the arm of a lever, so resting upon the end of the iron bar, that when the lever is lifted by the magnetic elongation of the bar, the beam of light is shot off from the mirror as a long weightless index. The change in the position of the molecules of iron by the action of magnetism is also proved by throwing the beam through a vertical cell of glass, containing magnetic oxide of iron suspended in water. When the cell is exposed to the influence of the poles of a strong electro-magnetic, the light passing through the cell and contained liquid to a screen beyond, brightens, in consequence of the metallic molecules turning themselves "end on" to the incidence of the beam. The lines of magnetic force assumed, when iron fillings are sprinkled over the poles of a magnet, are portrayed by the intervention of a system of lenses, which depicts the image upon the screen. The formation of the "tree of lead" upon the negative electrode of a voltaic current, when a salt of lead is decomposed by the current, is shown in the same way; the arborescent crystals glowing and dissolving alternately on the opposite poles, immersed in the solution as the direction of the current is reversed. The very beautiful colors and patterns of Nohili's rings, formed when lead is thrown down by voltaic decomposition upon a polished plate of steel, are exhibited by a similar intervention of lenses, and the illumination from the electric beam.

An artificial telegraph cable, whose resistance to the transmission of the electric current is made identical with 14,000 miles of an actual marine cable, is formed by introducing into the path of the current gaps, consisting of feebly conducting liquids and condensers, so distributed as to represent the respective distances by telegraphic route to Gibraltar Malta, Suez, Aden, Bombay, Calcutta, Rangoon, Singapore Java, and Australia. A mirror, belonging to each gap, lies in the path of the currents, carried by a galvanometer, constrained to deflect its needle from the position of both on the instant that the passage of the current is felt. Before the current is sent through the apparatus, ten dots of light, cast from the mirrors by the instrumentality of electric illumination, lie upon the screen, in a straight vertical range. When the current is passed through the apparatus, dot after dot starts aside upon the screen, as the current fills the condenser immediately before each mirror, and then flows beyond to deflect the galvanometer immediately in advance. The deflection of the successive galvanometers, and the corresponding traverse of the beam of light upon the screen, is seen, under this arrangement, to take place at successive steps or intervals which exactly express the intervals of time which the electric current would require to reach the several stations named, in the actual progress of telegraphy The starting aside of spot after spot upon the screen when the current is sent through the apparatus, and the subsequent return of spot after spot to the position of original test in inverse order, forms a very striking illustration of the fact that the resistance of an electric cable is in some degree dependent upon its length, and that time is consumed in overcoming this resistance. The most interesting and telling of all these beam-of-light illustrations, however, is certainly the one which is employed to indicate the excitement of diamagnetic force in a tube of copper, when it is suspended between the poles of an electro-magnetic. The tube is carried by a string of silk, and rotates rapidly under the influence of a twist given to the string. The string also carries above the tube a series of small mirrors, which reflect the light of an electric beam, so that a continuous elliptical band of illumination is formed on the screen whilst the twisting is continued. The instant the electro-magnet is made active by the transmission of the current through its helix, the copper tube acquires diamagnetic polarity by induction, and under the influence of this polarity the rotation is arrested, and the bands of light upon the screen is changed into a small stationary spot or illumination. When the electro-magnet is unmade by the arrest of the voltaic current, the spot of light again becomes an elliptical band, under the resumption of the twisting of the silk string with its mirrors and copper tube.

Of the numerous other very pleasing and telling illustrations exhibited in these lectures, space only permits allusion to be made to a very few which have been selected from the series, as being worthy of especial mention. The sound produced by the molecular vibration in iron when its mass is transiently magnetized by the voltaic current, is made audible by suspending an iron poker upon two sounding boards, and making it the core of a helix, conveying an electric current. An assistant is converted into an extemporized electrophorus, by flapping his black coat with fur while he stands upon a glass-legged stool. Small fish of gold leaf are made to float in the air current given off from the knob of a charged Leyden jar. A thick drinking glass is shattered by the expansion of the water contained in it, when sparks formed under the intensifying power of fifty condensers joined "in cascade," and primarily charged by a voltaic battery of one thousand cells, are passed through the liquid. To demonstrate the relation of resistance to heating power, a long line of wire is arranged in alternate links of platinum and silver, and when the voltaic current of due intensity is passed through the length, each stretch of the platinum wire is seen to glow with brilliant red heat, while the stretches of silver wire between remain still invisible. A beautiful series of Geissler's vacuum tubes were brought into successive operation, in which the auroral discharge was broken into stratified leaves, in which the glow was extinguished by the approximation of the poles of an electro-magnet, in which a feeble glow was converted into bright stratified light by the influence of a magnet; and beautiful beyond all the rest, the light from the inclosed negative terminal of the voltaic battery was arranged into the well-known lines of magnetic force, when subjected to the influence of the poles of a magnet.

Successor to Professor Magnus.—This lately deceased *savant* is to be succeeded by Professor Helmholtz, from Heidelberg University, who has been elected by the Council of Berlin University a Professor of Physics.

[For the Scientific American].

THE SCARABÆIDS.

[By Edward C.H. Day, of the School of Mines, Columbia College].

"How disgusting to the eye, how offensive to the smell, would be the whole face of Nature were the vast quantity of excrement daily falling to the earth from the various animals that inhabit it suffered to remain until gradually dissolved by the rain or decomposed by the elements." (Kirby and Spence). Few people perhaps have thought of this forbidding subject from exactly this point of view; yet we may profitably do so, for in nothing is the perfect working of the government of Nature more apparent than in her sanitary arrangements. The familiar illustrations of chemistry will at once recur to the mind of every one; but Nature knows that the operations of that power are sometimes slow, and that delay in effecting the necessary decomposition of worn-out organic matter might result in a widespread and undesirable destruction of living organisms. Moreover the best chemical processes are often accompanied by deleterious vapors, and such are not to be permitted in the natural economy of thickly inhabited districts; therefore Nature has her scavengers, wise beings who do not allow waste matters to lie about, uselessly tainting the pure air, but who turn it at once to some good purpose, and thus lighten the labors of the chemical department. Foremost amongst these useful members of the animal kingdom are many families of insects, and pre-eminent amongst these are the *Silphidæ* or carrion beetles, the *Staphylinidæ* or devil's coach-horses, and the *Scarabæids* or dung beetles. The first mentioned are simply destroyers of dead carcasses, whilst the last confine their labors chiefly to the removal of excrementitious matters. The readers of newspapers will be aware that we have in our cities the exact human counterparts of these occupations, but it is with the *Scarabæids* alone that we have at present to do. An occasion calls for the services of these servants of Nature's sanitary bureau; they are to be found at once on the spot; no excuses for delay are thought of, no jobbery will be winked at; they have the contract, and it will be carried out to the letter. If the weather is extraordinarily warm, extra feet and jaws will be set upon the task; the offensive substance is forthwith removed; it may be buried, it may be eaten, but it certainly is not taken from one place to be dumped in the same objectionable condition elsewhere in a populous neighborhood.

NATURE'S BOARD OF HEALTH—HER SCAVENGERS.

And see how these beetles at once convert it to a purpose useful to themselves and most economical to Nature; they actually make of it an edible nest for their own offspring, and thus raise from it a fresh generation of active, incorruptible scavengers, literally born and bred in the business! This may savor, at first sight, of monopoly—keeping a lucrative occupation in the family—but as the work is always well and honestly done, and this without the public being taxed for it, and as, if occasion requires, other animals may share in the perquisites, no one has any reason to complain.

But this is not the only economy accomplished by these creatures. There are cities in this the nineteenth century wasting all the sewage that should be applied to restore the fertility of the exhausted lands around them; there are farmers in this the age of Liebig and agricultural chemistry who allow the rain to wash the richest elements of their dung heaps out of the farmyard, to be wasted on the roadway or in the bed of the neighboring river; nay, worse, who suffer it to soak away into the family well, letting that which should be converted into food become a secret poison—the source of disease and death. But what a different lesson does Nature teach by her scavengers, who "not only disperse the dung, but actually bury it at the roots of the adjoining plants, and by these means contribute considerably to the fertility of our pastures, supplying the constant waste by an annual conveyance of fresh dung laid at the very root."

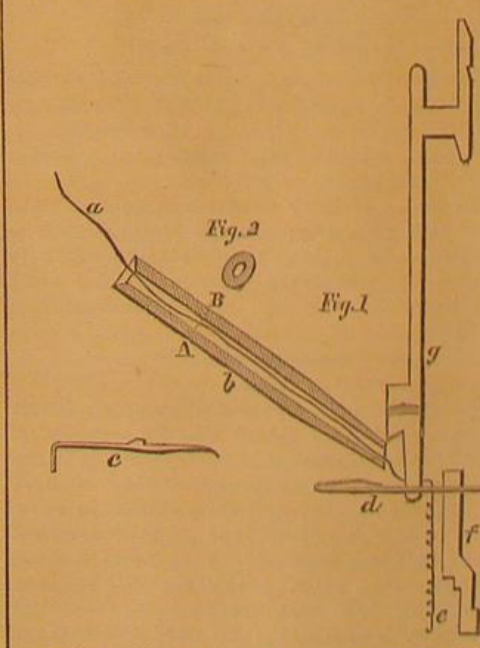
The *Scarabæids* have various ways of effecting this dispersion of offensive matters, and of these the most remarkable process, and the most amusing to watch, is that of the tumble bugs. See one after she has deposited an egg within a pellet of horse dung, rolling this ball along, trundling it skillfully with her hind legs, now heaving it, like Sisyphus, to the summit of an eminence, and now, Sisyphus-like, having to follow it down to the bottom, again to recommence the toilsome ascent; now digging under a stone, and with, comparatively speaking, far more than the strength of an elephant, heaving it out of her way, and then working it patiently round an obstacle that she cannot surmount; laboring on until she finally places it in a spot adapted for the security of its precious contents, and you may form some idea at once of the power of an insect's muscles, and of its indomitable industry and patience. If several tumble bugs, as is frequently the case, are at work together, you will learn that they are wise too, wise in the wisdom of unselfishness. No matter whose ball it is an individual comes across, she trundles it along. If she falls into difficulties, the others come to her aid; and if the difficulties prove insuperable, and that ball has to be deserted, she at once sets to work with another. It is as if these creatures said to one another: "What matter whether this ball is yours or mine? We have a common duty to perform; it would be folly for us to do as men do, cling each to his own and leave the rest to fate. The propagation of our race depends upon some eggs being stowed safely away; what does it matter whether they are mine or yours?" It is the story of the ants again; each for the whole community, and not for herself alone; it is the story of all Nature, and man is the only social being that disregards the moral.

It seems almost just that this insect, lowly, and, according to a refined taste, repulsive though its mode of life may be, should have been selected by the ancient Egyptians for the highest honors, though it is hardly probable that the sacred beetle obtained its religious significance from its curious habits. Noel Humphreys says: "With the sacerdotal naturalists of Egpyt, who had carefully observed the habits and transformations of the beetle, that insect became a symbol of the principle of metempsychosis and other theological dogmas;" and in Figuier's "Insect World" we find the following more extraordinary explanation: "Hor-Apollon, the learned commentator on Egyptian hieroglyphics, thinks that this people, in adopting the *Scarabæus* as a religious symbol, wished to represent at once *a unique birth, a father, the world, a man.* The *unique birth* means that the *Scarabæus* has no mother. A male wishing to procreate, said the Egyptians, takes the dung of an ox, works it up into a ball, and gives it the shape of the world, rolls it with its hind legs from east to west, and places it in the ground, where it remains twenty-eight days. The twenty-ninth day, it throws its ball, now open, into the water, and there comes forth a male *Scarabæus.* This explanation shows also why the *Scarabæus* was employed to represent at the same time, a *father*, a *man*, and the *world.*" If the priests really believed that the *Scarabæi* were all males, it does not speak much for their powers of observation; if they did not believe it, then Hor-Apollon's statement gives them credit for a wonderfully inventive imagination. We incline to the latter alternative. There are at least two species of *Ateuchus* figured on Egyptian monuments; the one here represented the *Ateuchus sacer*, common in the countries around the Mediterranean, a black insect; and the other the *A. Egyptiorum*, an insect of brilliant metallic green color, more rarely found and more exclusively African.

Knitting Machinery.

The following is an abstract (from *Engineering*) of a paper recently read before the Institution of Mechanical Engineers, at Nottingham, England, by Mr. Arthur Paget, of Loughboro:

"In introduction of the subject the author stated that the date at which the appliances for knitting had been brought within the limits of machinery as strictly so called, was very recent, and the subject of knitting and machinery for that purpose had been so much out of the pale of mechanical science that some explanation was necessary as a preliminary showing the nature of the structure of knitted web. This was done by the aid of diagrams, and it was remarked that in most knitted articles it was necessary that the web, as it was made, should be shaped during the process of making the web from the thread or yarn, and this was one great peculiarity of the hosiery manufacture, that shaped wearing apparel, comprising the numerous descriptions of underclothing, was produced direct from the yarn at one operation of the machine, and without the intervention of the tailor or milliner; and the weaver of calico cloth, or other such fabrics, would hardly realize at once the enormous amount of detail which this peculiarity entailed in the manufacture of hosiery to suit all the different shapes and qualities required, and the consequent necessity that the machines employed should be easily adapted to make articles of very great variety of shapes, thickness, and degrees of elasticity. The framework-knitter's old hand frame, though now doomed to the same fate as many other clever contrivances of former years, was even yet in this district the means of producing probably the larger part of the hosiery made. The subject of the present paper was the self-acting power frame, three specimens of which were exhibited to the meeting.



"To enable the construction of this machine to be more readily understood, the author stated that it would be desirable, first to consider the five primary parts by which the operation of knitting the thread into web is performed, and then to explain the manner in which these several parts had the proper movement imparted to them Still further, to facilitate the comprehension of the movements of the machine, there were distributed to the members present cards having fixed upon them in their proper relative positions specimens and drawings of the primary parts just referred to. From one of these cards the accompanying sketch has been prepared, *a*, in the diagram, being the thread; *b*, the thread tube; *c*, the "coverer"; *d*, the needle; *e*, the knitted web; *f*, the "knocking over bit"; and *g*, the sinker. By the aid of this diagram it may, perhaps, be possible to give a general idea of the action of the machine, which was fully and clearly described by the author in his paper, an extensive series of diagrams, showing the various parts in the positions they successively assume, being employed to illustrate the matter.

In the annexed sketch the knitted web is shown hanging on the needles, which are fixed side by side in a row of the necessary length. The thread tube has a motion to and fro across the needles, and the thread depositited by it is carried down between the needles by the sinkers, so as to form a series of loops. The sinkers are of thin steel, and they are arranged so that they can rise and fall between the needles. The line of thread having been deposited over the needles, the latter retire, and the new loop over each passes under the barb or part of the needle which is turned over. Later on, a presser bar descends and closes this turned over portion, so that its point enters into a groove formed in the top of the needle to receive it; and the retiring motion of the needle still continuing, and the sinker being raised, the old loop on the needle is by the action of the "knocking over bit" caused to pass over the closed barb of the needle, and thus over the new loop (which is inclosed within the barb) also. The sinker then descends again, and the web being then between it and the "knocking over bit," is held close to the latter as the needle advances with the barb released, the new loop being thus made to take up the position occupied by the old loop at the commencement of the circle of operations. The manner in which the primary parts above referred to have the requisite motion given to them, was fully described in the paper.

Having explained the mode of making the web, the author next described the operation of varying the width or narrowing. This is effected by withdrawing two needles at a time, at various intervals. The elasticity of the web prevented any appearance of sudden step instead of a suitable curve. The essential principle of narrowing is that the two loops to be narrowed are moved from two needles at the edge of the web, and are transferred to the two needles next to them and nearer to the centre of the width of the machine. Thus these two needles have each two loops upon them, and one of the loops of the next row is then drawn through each of these pairs of loops, and the loops which would otherwise have run down are held secure. The transferring of the loops from one pair of needles to the next pair is effected by means of the coverers, which are grooved on their under side so as to fit over the barbs of the needles. To effect the transfer of the loops two coverers at each edge of the web are advanced towards the corresponding needles so to take the loops off them. They are next drawn back and moved lateraly so as to come opposite the needles on which the loops are to be deposited, and they are then moved forward to these needles and caused to place the stitches on them.

"Having described the above mentioned operations, the author went on to state that the shaping of the articles was

governed by the employment of a peculiar form of endless chain, commonly known in France as the *chaine Vaucauson*. This chain is advanced one link at the formation of each row by the machine, and at proper intervals links of peculiar shape are introduced, which, by acting on inclines, throw out of action the cams moving the needles, and bring into action those working the "coverers," the first mentioned cams being brought into action again as soon as the narrowing has been effected. A link of special form also is used to stop the machine on the completion of a piece of work. The speed of work, as compared with the older methods of knitting, was shown by the fact, as the author believed, that a skilled knitter, with the ordinary knitting pins, would knit about 60 stitches or loops per minute in knitting the leg of a stocking, and a skilled framework knitter, with his hand frame, will knit on the same work 5,400 stitches per minute, whereas a girl, will on the same work, attend to three of the self-acting machines, each making 50 courses per minute, of 13½ inches wide, and 20 stitches to the inch, thus making 40,500 stitches per minute.

Correspondence.

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

Copper Poisoning.

Messrs. Editors:—The following notes taken from my case book (stated in the Baltimore *Medical Bulletin*, April, 1870), may, as other similar cases, serve as a caution against the use of brass or untinned copper cooking utensils:

March 14, 1868, seven persons—five being adults—soon after eating for dinner, in a public house, stewed fruit (dried peaches) that had been cooked in a brass kettle, were attacked with the following symptoms: Pain in the epigastrium extending over the abdomen, nausea, violent vomiting in some cases, and diarrhea. In some, the gastric distress was extreme, followed by giddiness and depression. All recovered, or nearly, within thirty-six hours. All those, and those only, who partook of the fruit were attacked and had the same symptoms.

Two ladies, of the above sick number, of undoubted veracity, one of whom superintended culinary affairs, stated that the peaches after being cooled were removed from the fire and not suffered to remain in the vessel, which was previously well cleansed. This fact, which is remarkable, is mentioned to show the possibility of accident, even when care is used with a view to prevent it.

Being requested by the proprietor to subject the fruit left over to chemical examinaion, this was done with the following result: First, the peaches not cooked, of the same lot which had been stewed, were examined for copper, but none was detected; iron found in large proportion, this being a normal constituent of organic matter generally, especially so with peaches. The peaches of the same lot which had been used for the table (all having been cooked in the brass kettle) were next examined, when copper was found in small proportion, this accounting for the symptoms. No arsenic, no antimony, no hydrocyanic acid. For the last substance, however, an examination was unnecessary, it being so volatile, if ever present, as to have been dispelled by the heat previously employed; moreover, the symptoms were unlike the effects of prussic acid. In searching for copper, ferrocyanide of potassium and the iron test were chiefly relied upon; for antimony, Marsh's test; for arsenious acid, Reinsch's and Marsh's tests.

Snow Hill, Md. Medicus.

Moon Fallacies.

Messrs. Editors:—In the Scientific American of Aug. 6th, on page 86, you publish an article under the caption of "A Moon Fallacy Exposed," taken from the *American Builder*. The writer quotes from M. Dechamel, a celebrated French agriculturist, which ought to be good authority; but whether the moon has any influence on the timber being cut in the different phases of that planet or not seems to be the question under discussion.

Certain facts relative to this matter have come under my observation so forcibly that I am inclined to think there is some truth in what are termed "fallacies" on this subject. Whether the moon exerts this influence or not, I do not pretend to argue; but I am quite certain if hickory timber, for instance, be cut between the full and new moon, the worms will devour it; but if cut, say three days after the new moon, up to within three or four days before the full moon, the worms will not touch it.

Let some of your country correspondents give this matter a trial. Cut a stick of hickory, say three or four days after the full of the moon, and then cut another stick of the same kind of wood, say three to four days after the new of the moon, and set these sticks up side by side for a few months, and then let us hear the result.

I venture to say, the former of these two will become worm-eaten, and the latter will show no signs of worms or wood borers. Several other facts that would be classed as "moon fallacies" have came under my observation; but let the above suffice for the present. D. A. M.

Cincinnati, Ohio.

A New Trade---Fish Oil.

Messrs. Editors:—The Californian, Connecticut, and Massachusetts newspapers have been congratulating their countrymen that a "new trade" is open to them for the manufacture of the above oil, alleging as a reason "the desertion of the sardine, mackerel, etc., from the coasts of France and Spain," and "the export thereto of roes and spawn from the United States."

The true state of the case is this: Liverpool (and the neighborhood) is famous for its soap manufactories, and turns out some 50,000 boxes *weekly*. Common fish oils, when obtainable, are largely used in fabricating soft, and cheap hard soaps. Our people suggested to the French and Spaniards that instead of packing the sardine for edible purposes only, they should press them into oil with the spare roes of any other fish that could be procured, and consign to England for sale and a market. The hint was carried out so successfully that within these last twelve months, 1,000 tuns of sardine, and other fish oil have come to this market, and have sold readily at £33 and £35, equal to $160 and $168, gold, per tun of 252 gallons (nine pounds per gallon). This new application of the sardine has competed so completely with its previous use for the table, that enough fish are not to be got for "casing," and the dearth now in France and Spain is not that the production is *less*, but that the consumption is *more*. Hence the demand for American roes.

There is therefore vast scope along the almost unlimited American coast for the catch and press of any amount of fish and roes; and be the oil ever so inferior, we can take it at about the quotation given. In this, then, there was just cause for the congratulation referred to, and the soapers of this country will be glad to welcome any quantity of common fish oil that the producers of the United States can remuneratively send them.

Liverpool, England. A. M.

Balancing Cylinders.

Messrs. Editors:—I see by the Scientific American, of August 13, that C. E. M., of N. Y., like many others, does not quite understand why his shaft, being balanced, should shake so.

Now, let us suppose we have a cylinder four or less feet long and twelve inches in diameter, built of staves on iron rings, the same as a thrashing machine cylinder or a card cylinder. We will suppose that when built it is perfectly balanced. Now let us bore a hole in the end of a stave at one end of the cylinder, and put into the hole so bored one pound of metal; then the cylinder will be so much out of balance. Now we will bore a similar hole at the other end of the cylinder, but on the opposite side. Now, if a similar piece of iron or metal of same weight be inserted it will be balanced again if laid on level, parallel steel bars, but will be out of balance while running; and this is what ails his shaft.

The only way that I have found successful is to balance while running, or rather to test while in motion. If pulleys have much force and high speed they will require to be balanced in the same way. W. O. Jacobi.

Mellenville, N. Y.

[Our correspondent would add much to the value of his communication if he will explain how, unless centrifugal force acting unequally on the opposite sides of the cylinder destroys its regular form, the cylinder will, after being balanced as described, be out of balance when running. Also, if he would give his method of balancing or testing cylinders while running. The first will be a theoretical point of interest to many who will disagree with his conclusions. The second is a matter of practical importance. If cylinders can be so balance!—which we doubt—the mechanical world would like to know it.—Eds.

New Bread.

Messrs. Editors:—Your paper of the 13th of August had an article headed "New Bread," asking why it is unwholesome. The true answer to this question is, I conceive, to be found in an account, published some years ago, of some experiments made upon the soldier St. Martin, a part of whose stomach was shot away, leaving an opening by which food could be introduced, and the process of digestion watched and carefully noted. In new bread the process of fermentation is checked, but not entirely stopped, by the drying out of the moisture in baking. It appeared from the experiments on St. Martin that when new bread was introduced into his stomach the heat and moisture caused the fermentation to recommence before the process of digestion had commenced, greatly interfering with it. W.

Screw-Holes in Cast Hinges.

Messrs. Editors:—Can manufacturers of cast butt hinges be induced to diminish their sales and benefit the public by diminishing the number of screw holes in their hinges?

The breaking of a cast hinge is a common occurrence—the breaking or wrenching out of a screw is rare.

Three holes in an ordinary shutter hinge, for example, will, by so decreasing the strength of the hinge, cause it to break from a strain that would be harmless if there were only two screw holes. A great saving in screws and labor would also be effected. Wm. C. Butler.

Sassafras, Md.

Dyeing Wood.

Messrs. Editors:—In No. 4, present volume of the Scientific American, one of your readers asks for a method of dyeing some of the lighter colored and cheaper woods to the natural color of walnut. Here is the process which Mr. J. B. Rochard, a French carpenter, used while working in Paris. Take green husks of walnuts (Brou) and put them to macerate in water for say fifteen days. At the end of that time boil them a little in the same water. Let the decoction cool, and use it by soaking a piece of rag in it and rubbing the surface of the wood with it. Two rubbings will give to the wood the color desired. When wanted to dye hard wood, like oak, rub the wood previously with salt of niter and proceed as before.

Jacksonville, Fla. F. Guicheteau.

Lowest Line of Perpetual Snow.

Messrs. Editors:—In your number of August 6th, page 85, is a communication on this subject, indicating that there is something like a uniformity in the snow line in the same latitude, whereas the fact is quite the reverse, depending on a great diversity of circumstances.

On detached high peaks, like Teneriffe, it descends low for the latitude. On the Himalayas, it descends lower on the south side where the descent is abrupt, than on the north where the descent is less, and to an elevated extended table land.

And do we not see the same thing in America? The line of perpetual snow descends lower on Mount Hood and other peaks of the Cascade and Nevada range, with its abrupt western slope, almost to the ocean level, than on the peaks and ranges of the high table land of the Rocky Mountains.

And though the temperature on the west sides of the great continents is much milder than in the interior and on the east sides on lower lands, does that apply to the same degree at high altitudes? My impression is that it does not.

Grand Rapids, Mich. John Bull.

Tin Fruit Cans.

Messrs. Editors:—There are various qualities of tin purchased by fruit packers for manufacturing their cans. You probably know as well as any one of what the coating of that tin consists, whether it is all pure tin or a mixture of tin and lead. I have several times eaten peaches which had a decidedly metallic flavor, and have suspected that it was derived from the coating of the cans. I have reason to think that packers use the cheapest grade of tin for fruit, and that they use different grades for oysters and vegetables. A. B.

Balancing Pulleys and Shafting.

Messrs. Editors:—If C. E. M., of N. Y., will take his pulleys from the shaft, and balance each one separately, he will have no further trouble with their shaking, if the shaft is of proper dimensions.

In my opinion, the trouble will be found in this, that the maker of the machine balanced the pulleys on the shaft. This practice is all wrong. Work balanced in this way will not run steadily. J. G. F.

Winchendon, Mass.

How the Dead Soldiers are to be Identified.

A Berlin letter says: "Mark one instance of the German practical spirit as a proof of the fashion after which these Teutons prepare to fight. In recent wars popular feeling has demanded that rank and file, captains and generals, shall be equally and impartially mentioned in the lists of the slain; but difficulties have arisen, because the enemy cannot know the dead men's names, and when the muster roll is called after battle, the missing may be only wounded or prisoners. Germany has in her solid, calm manner, arranged, in view of this difficulty, that each wife and mother shall speedily know the best or the worst about those who go to fight 'with God, for King and Fatherland.' Slips of parchment, like luggage labels have been prepared, on which the number of each German soldier is plainly written, and one of these will be fastened inside his coat when he goes into action. After the day is decided, the enemy, if he be master of the field, will be requested to collect and return these labels, of which about a million have been provided, grim tickets for an unknown journey! Think of the German wife or mother sewing it on—the battle ticket of her stake in the quarrel—the address of her particular 'material of war,' the awful traveling label whereon no loving hand may write 'with care,' seeing that its bearer goes into the Valley of the Shadow, to come forth again or not as Heaven shall decree. Sewn on with German thread, ripped off, perchance, with French knife, whole packets and parcels of these little human memoranda will surely be returned; but yet every man who buttons his coat over the label of death has looked his fate full into the face, and made himself 'ready for the burial.'"

The Fly-catching Plant.

In an article on "Flowers in Paris" in the last number of *London Society*, the writer says:

"A very curious fly-catching plant, flowered in my garden this summer, and a most curious inflorescence it is. The Corsican arum, *Arum crinitum* or *muscivorum*, called by French gardeners *gouet-chevelu* and *Attrape-mouche* (please not to confound this either with the Dragon or Italian arums, *A. dracunculus* and *Italicum*), produces a flower like the common arum of the hedges, only much larger, and with the upper part bent downwards, as if it were an accidental distortion. Both the central spadix and the spathe are thickly covered with dull purple bristles (whence its name *crinitum* and *chevelu*).

"The spathe contracts towards the base, like an hourglass, and there issues from it a faint cadaverous smell. This attracts blow-flies, blue and green. They come accordingly, not in swarms, but one by one, leisurely and taking it easy; and there are no outward and visible signs of their being caught.

"You skeptically ask yourself why the plant is named *muscivorum* or *attrape-mouche*. By-and-by, perhaps, when the spathe is shriveled, you tear it open to see whether you have any chance of obtaining seed, and the secret is revealed. At the bottom you find dead flies by scores, beguiled into a sort of vegetable Black Hole of Calcutta. Like the animals that entered the lion's den, all their footsteps pointed inwards; none came out; the bristles prevented them.

"Another year, I should like to try whether those bristles have any motion of irritability, or power of entangling and shutting in their victims."

STONE SAWING.

[From Byrne's Handbook for the Artisan.]

The softer varieties of stone admit of being cut into slabs and smaller pieces with toothed saws, which are sometimes made of a similar form to the cross-cutting saws for wood with upright teeth; but the toothed saws for soft stone are generally made somewhat wider in the middle than those for wood, so as to make the blade more rounding in the direction of its length, and, instead of being reciprocated backwards and forwards nearly in a horizontal line, as for cross-cutting wood, the toothed saws for stone are used with a swinging stroke, so as to act upon only a moderate portion of the length of the cut at the one instant of time; this is done to reduce the labor, and give the saw teeth more penetration. Some of these very soft stones are worked with chisels and gouges similar to those of the carpenter, and they may even be worked into moldings with planes like those for hard wood, but this is not generally practiced.

Slate is sawn and sometimes planed with cutting tools, very similar to those used for wood, except that they are stronger and applied by machinery, the action being partly cutting and partly forcing off the flakes of slate, as, if the tools are allowed merely to scrape over the surface, their edges become rapidly worn away. But the various sandstones, limestones, and marbles are too compact to be thus treated, and they are consequently worked almost exclusively by the chipping-chisel and various abrasive processes; the chisel being used for such parts of the material as are in excess, as in sculptured works, and the abrasive process being employed for dividing the blocks into slabs and small pieces, which are subsequently ground to the required forms with sand and water. In the case of marble, the pieces are finally polished with abrasive powders applied on rubbers of various materials.

The ordinary saw, used in dividing blocks of stone and marble into flat slabs, consists of a parallel blade of soft iron from five to ten feet long, from four to five inches wide, and from one eighth to one sixth of an inch thick, the blade is perforated near each end with a hole about three quarters of an inch in dameter, for the reception of an iron pin, by which the saw is strained in a rectangular wooden frame. The blade is inserted in the saw kerfs in the upright sides of the frame, called the *heads*, and the pins rest in two notches near the lower extremities of the heads, which serve as the handles of the saw, and are kept distended by the wooden stretcher called the *pole*, placed about a foot from the upper ends of the heads, and rested at each end against a loose block of wood called the *bolster*.

Instead of a coil of string twisted with a short lever being employed for drawing the upper ends of the frame together, as in the saws for wood, this object is effected by the use of a kind of chain made of looped iron rods, with intermediate C-shaped links, for adjusting the total length of the chain, which is furnished with iron loops that embrace the upper ends of the heads. The tenison is given by a right and left hand screw fitted to two looped nuts, attached to the iron rod by C links; the double screw has holes for a lever, by which it is twisted so as to draw the upper ends of the heads of the frame together with great force, and thereby stretch the saw in a most effectual manner.

The depth to which the saw can penetrate is limited by the distance from the edge of the blade to the under side of the pole; the nearer the pole is to the saw, the greater is the stability of the blade, and all the parts of the frame are made detached, so as to allow of their being combined and adjusted to suit the different sizes of blocks of stone. The same pair of heads are used with poles and saws of various lengths, and the pole is placed at different hights from the blade, according to the depths of the blocks of stone. When the latter are very deep, a longer pair of heads are substituted, but long heads are avoided as much as possible, as the stability of the saw frame is thereby much reduced.

The blade of the stone saw, like the metal laps used for grinding generally, does not itself cut the stone, but simply serves as a vehicle for the application of the sand, which acts as the teeth of the saw, and performs the cutting process. The coarseness of the sand that is employed depends upon the hardness of the stone to be cut; for moderately soft stone a coarse sharp sand is employed, and for the harder varieties of marble a fine sand is used; the sand or grit generally employed for cutting stone is obtained from the scrapings of roads paved with flint. The scrapings are sifted through perforated copper sieves, much the same as emery, as it is of great importance that the sand should be clean and free from small pieces of stone, or any other extraneous matters. Should a small piece of wood or a bit of coarse gravel by any accident get into the kerf beneath the saw blade, the little piece would roll over backwards and forwards, and materially impede the cutting of the block, and it then becomes necessary to remove the saw and wash away the obstacle, by pouring water down the saw kerf.

The cutting action of the sand is assisted by a small stream of water, supplied from a barrel placed a little above the block of stone. A small hole is made near the bottom of the barrel, to which is fitted a spigot and faucet, or more commonly a loose wooden peg grooved up the one side, which allows of the escape of a minute stream of water, that trickles down a sloping board placed so as to lead the water into the saw kerf. A little heap of sand is placed near the path of the water, and the workman is provided with a wooden stick with an iron hook at the end, or more commonly an old knife-blade placed at right angles to the stick near its end. This tool is called a *drip-stick*, and is used occasionally to draw forward a small quantity of sand into the running water, which thus carries down the necessary supply of sand for the cut, and the water flows away at the ends of the kerf, carrying with it the worn-out sand and the particles of stone removed in the cutting; the drip-stick is also used for tapping the wooden peg, so as to increase or diminish the flow of water according to circumstances.

The weight of the saw and frame supplies the necessary pressure for causing the penetration of the sand, so that the workman has only to guide the saw, and push it backwards and forwards for the cut, and when the pressure is so great as to render the work too laborious, a counterpoise weight is hung from a pulley placed over the saw frame, to which a cord is attached, so as to reduce the pressure to the required amount. Under this arrangement, the saw works more easily, but it does not cut so rapidly.

For marking upon the block of stone or marble the lines upon which it is to be sawn, as for cutting it into slabs of one or two inches thickness, the block is first shifted upon rollers into the position in which it is to be sawn; it is then mounted upon square pieces of wood called *skids*, with that side of the block upwards which is to constitute the edges of the desired slabs; and, as the blocks are frequently of very irregular forms, it is necessary to make one line around the top and two ends of the block to serve as the basis from which the other lines are set off, much the same as in setting out round timber.

The position of the first line having been determined, so as to allow of the greatest number of parallel slabs being cut from the block, two marks are made on the top of the stone close to the ends, with a piece of soft black slate found amongst coal, and called *black*; a line is then drawn, under the guidance of a straight edge, to connect these two marks, and the line is continued down one end, also with the straight edge. An equal distance is then set off at the bottom of the opposite end, and a line is drawn to serve as a temporary guide; two straight edges, each from two to three feet longer than the depth of the block, are applied to the two end lines, and the workman looks along the line of the two straight edges, to see if they are parallel to each other, or out of winding, in much the same manner as in the application of the winding sticks to narrow works in wood, except that, for setting out the blocks of stone, the straight edges are placed perpendicular instead of horizontal. Should the straight edges not appear parallel to each other, the one at the second end of the stone is shifted at the bottom until the two straight edges are in one plane; the permanent line at the second end of the block is then drawn in the corrected position of the straight edge, and if the work has been correctly performed, all three lines will be in the same plane. The thicknesses of the required slabs are then gaged off from this foundation line, and the lines on the top are *chased*, or cut in about one eighth of an inch deep with a narrow chisel, to form a groove in which the edge of the saw is placed for the commencement of the cut. The end lines are also chased, as the water and sand would wash out the black lines.

Before commencing the sawing, the workman examines with a plumb line whether the end lines are vertical, and if not, wedges are driven under one side of the block, to bring the end lines exactly upright; the saw is then inserted in the groove, and the sawing is proceeded with, care being taken in the first entry to keep the saw quite upright, which is greatly assisted by the hight of the saw-frame. Should the saw make the cut a little oblique to the lines, the position of the saw is slightly twisted in the saw-kerfs of the wooden heads, by blows of a hammer applied on one side of the pins which retain the blade in the frame, and which causes the saw to cut in the reverse direction. The necessity for changing the direction of the cut is, however, avoided as much as possible, as it makes the surface of the slabs irregular from the hollows thus produced. The necessity for grinding out these much increases the labor of producing a flat surface on the slabs, and the thickness of which is also lessened; this it is sometimes an important object to avoid with valuable marbles, which are occasionally cut into veneers for inlaying, which do not exceed one eighth of an inch in thickness.

The length of the traverse of the saw is generally about twenty inches, and a saw is therefore chosen that is about two feet longer than the block to be cut, as the shorter the saw that can be efficiently used the more firmly the blade is held. When two small blocks are to be cut, they are frequently placed end to end with the intended cuts in the same plane; and to prevent the sand and water, called the *feed*, from flowing out between the stones, the interval is filled up with straw rammed in firmly between the two blocks; in the case of light-colored marbles, clean shavings are used for this purpose, as the straw would stain the surfaces unless the slabs were washed immediately afterwards.

After the marble has been cut into slabs with the stone saw, if it is required to be reduced into smaller pieces, or narrow slips, such as shelves, or the sides of chimney-pieces, the slab is laid on a bench, having a flat surface of hard stone, or marble, called a *rubbing-bed*. The lines indicating the margins of the required pieces are marked with the straight edge, and black lead, and the lines are chased with a narrow chisel, as for the entry of the stone saw, but the cutting is effected with smaller blades, called *grub saws*; they consist of plates of iron from one-twentieth to one tenth of an inch thick, from six inches to four feet long, and six to eight inches wide when new. These blades are not stretched in a frame, but are stiffened by having their upper edges clamped between two pieces of wood extending their whole length, and measuring about two inches wide and one inch thick, the whole being held together by means of ordinary wood screws, passing through holes in the plate, so as to form a wooden back something like those of the dovetail saws, and which serves as the handle by which the grub saw is used.

The blade should always be shorter than the length of the cut to be made, as, should the blade be longer than the cut, it would be worn hollow from the greater amount of rubbing to which the middle would be exposed; but when the grub saw is much shorter than the cut, it is liable to be worn rounding in its length. To counteract this tendency, the grub saws are sometimes filed, at every four or five inches, with angular notches about three fourths of an inch deep, and which also allow the feed, or the sand and water, to reach the bottom of the cut with greater facility, and the grub saws are consequently considered to cut rather faster for the notches.

The width of the iron blade measured to the wooden back limits the depth of the cut to which the grub saw can be applied, and, in selecting a saw for any particular piece of stone, preference is given to as narrow a blade as can be fairly applied to that thickness, as, when the blade is wide, it is rather feeble sideways, and it is besides more liable to be twisted from the perpendicular, when rubbed backwards and forwards in the cut, with one or both hands applied on the back of the saw near the middle of its length.

Washing out a Mill Race, or Foundation by Sluicing.

We learned from a friend, a returned Californian, who had seen several attempts made to wash out a race or a foundation by water, and had once tried it, but all these attempts ended in confusion and vexation, for the reason that they were all begun at the wrong end. That is, the water was shot down from a hight above into the foundation, or upper end of the race, without any proper facility being provided for carrying away the gravel and small stones; the result was always the same; the water would excavate a deep hole where it struck, but only the soft loam and clay were melted and carried away by the water, the stones and sand remaining and blocking up the channel, and it was found cheaper and better to plow and scrape the earth out. But Mr. Whipple, the Californian alluded to, has shown us the principle of *sluicing*, which experience has proved to be the cheapest and best method of making such excavations. He sluiced out a tail-race and wheel pit this winter (1869) in a hard gravel soil, in a very short time; he placed a sluice (by nailing three boards together, forming a bottom and sides, and open at top) at the lowest end or discharge of the race, and ran the water down the intended route, and through this first length of sluice into the river. He then commenced at the end of this length and loosened the earth with a pick or crowbar to the required depth and width, and the water, rushing down from the unbroken surface above, swept the earth and stones down the spout into the main stream. When thus exavated to the proper distance, another length of sluice was added, a little straw stuffed under the end, and each side blocked up with stones to direct the water into the end, and another length loosened and sent through the sluice, as before. This process was continued until the race was completed, and the foundation for the wheel-house reached; and here the benefit of Mr. Whipple's Californian experience was more conspicuous than in digging the race, because the depth of excavation here was so great that the earth would have had to be wheeled to get it out of the way, and this is always a tedious process; but he sent all the earth and moderate sized stones down the sluice and river in an incredibly short time; by shifting the chute of water upon different parts, and loosening and throwing out the larger stones, thus giving the rest a proper facility of entering the sluice, it was swept down stream by the water, requiring only a little assistance with a hoe or shovel when large or flat stones would incline to stop and obstruct the passage.

Any person who does not comprehend the assistance which such a sluice renders, to enable the water to carry away stones and gravel, may satisfy himself by trying to shovel or push such gravel and stones on top of their natural bed, and then try to shovel the same, or push them along in such a sluice; or let him try to shovel potatoes from the top of a bin, and then try shoveling them on a wooden floor.

Care should be to place each length of sluice at the full and proper depth at first, and also to give each length an equal and sufficient fall to insure the requisite rapidity of current. By Mr. Whipple's experience, two inches of fall in one length of board, or twelve feet, will carry along stones the size of potatoes, or a man's fist, while three or four inches tall to each length will roll along stones as large as a man's head. Of course, a sufficient supply of water is necessary in all such operations.—*The Practical American Millwright and Miller.*

GLASS WALLS.—Among the novelties in garden arrangements an English builder has lately patented a system of erecting walls of glass. These walls are formed of grooved T-iron. Stands of the required hight are fixed at four or five feet apart into a foundation of brickwork, stone, or blocks of wood, and bound together at the top by a coping which projects three inches on each side. Into the grooves rough plate glass is placed, being held in position by a packing of felt, the slabs being butt-jointed; and thus, when the coping is put on, the work is complete. Nothing can be more simple than the arrangement and construction of these walls, and they are unexceptionable in point of appearance. They are open to objections, but may be useful under some circumstances.

MATHEMATICAL AND OPTICAL.—James W. Queen & Co., the well-known mathematical and optical instrument makers, of Philadelphia, have opened a branch of their establishment in this city, at No. 5 Dey St. Their advertisement appears in our advertising columns. We can recommend this firm to such of our readers as desire to purchase articles in their line or trade.

THERE are two hundred and forty-one and five-eighths miles of paved streets in the city of New York.

(Continued from First Page.)

to the chain. This insures the discharge of the most difficult material. The short receiving spouts under the buckets, and the one between them, are hung on pivots in the center, so that either end may be elevated, and the contents of both sets of buckets discharged on either side, or both sides, as may be desired.

Whenever the extent of the work requiring a lateral deposit is sufficient, the hull of the dredge may be built long enough, and lean enough aft, to balance the machinery forward, without the counter balance.

When the work is situated in water deep enough in front of the dredge to float the loaded lighters, the buckets like B, Fig. 5, which dump through the bottom, are brought into requisition, the latch to these may be tripped anywhere on their perpendicular way up, and discharged into a short vibrating spout, which conveys the material directly into the lighter, placed much nearer than it can be in any other arrangement—thus saving power in proportion to the hight of discharge.

Fig. 6 is a gang of hooks, sometimes put upon the chains between the buckets, when working in hard, coarse material, like cobblestone, shale, or hardpan. The chain is so constructed that any shaped bucket, or any other device for loosening the material, that might be found in practice to be preferable, may be put upon it. All the articles here represented have been fully tested, and found very useful in their places. No sacrifice of power, or of economy in working, has been required in using all these appliances on the same machine; on the contrary, it is claimed that the perpendicular position of the working part of the chains, and their passing around three drums instead of two, are great improvements under all circumstances.

The perpendicular application of power secures economy of friction, in the wear of rollers, ways, etc., especially where no lubricating material can be used, nor the wearing parts secured from the destructive action of sand and water, which must always be present in dredging.

The third drum, which constitutes the flange wheels, G, is used to raise the buckets from the bottom, in the manner above mentioned, without changing the perpendicular position of the working part of the chain. It also furnishes the best possible position for the discharge of buckets like B, Fig. 3, at all times when that kind of bucket is in use. Also, that of B, Fig. 4, which dumps between the two upper drums, requiring nearly a horizontal position to discharge.

The bucket, B, Fig. 5, may be dumped anywhere on the perpendicular part of the chain, by raising or lowering the vibrating spout which trips the latch. This is the most economical of all the different buckets, where circumstances are favorable for its use, as it dumps, with perfect freedom, all kinds of material, and is discharged at a much less elevation, on account of its better relative position with respect to the lighters.

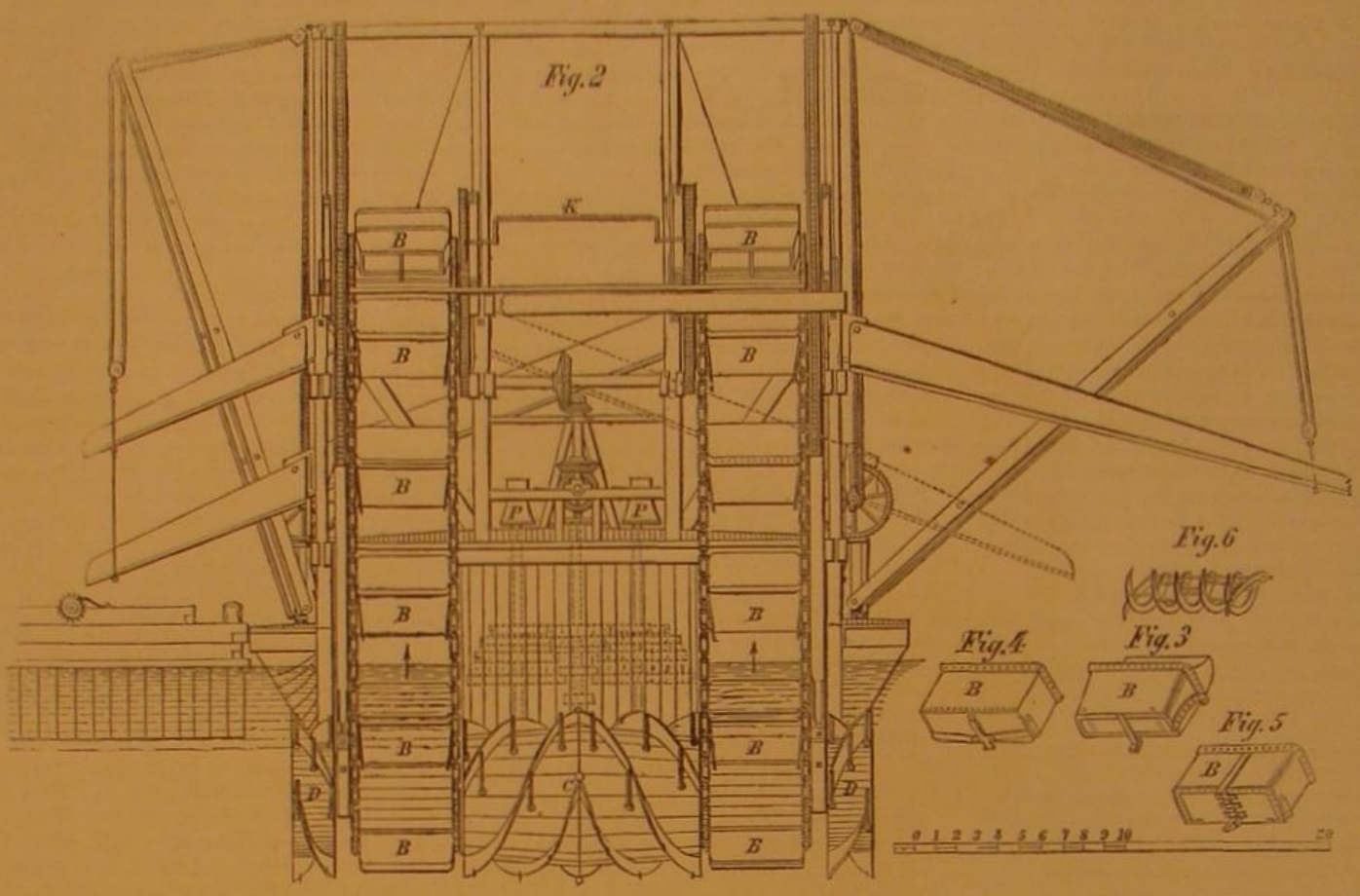
In working these machines, a pulley is anchored at a convenient distance ahead, with a feed line passing from one of the feeding capstans, P, through the pulley and back to the other capstan, either one of which, or both, may be worked by the adjustable machinery to any required motion, by a change in the series of clutches at Q, or a series of wheels below deck; while the spiral cylinders below water, with the buckets, clear the way to the full width of the dredge, and to the depth required, bringing up the material and depositing it in lighters, or on the banks, or at any distance in any direction horizontally, not exceeding one in twelve of the altitude overcome, by supporting a spout, lined with sheet iron of the length required, on a movable support, that it may coincide with the feed motion of the dredge.

The distance from the dredge at which the deposit is required, determines the length and inclination of the spouts. Something, however, depends upon the nature of the material excavated. If it contain clay, or vegetable matter sufficient to prevent the water from draining out too soon, it will run on a descent of one inch to the foot, without more water than the buckets bring up with it; but if the material be pure sand or gravel, a pump will be required to assist in the discharge, without more inclination of the spout.

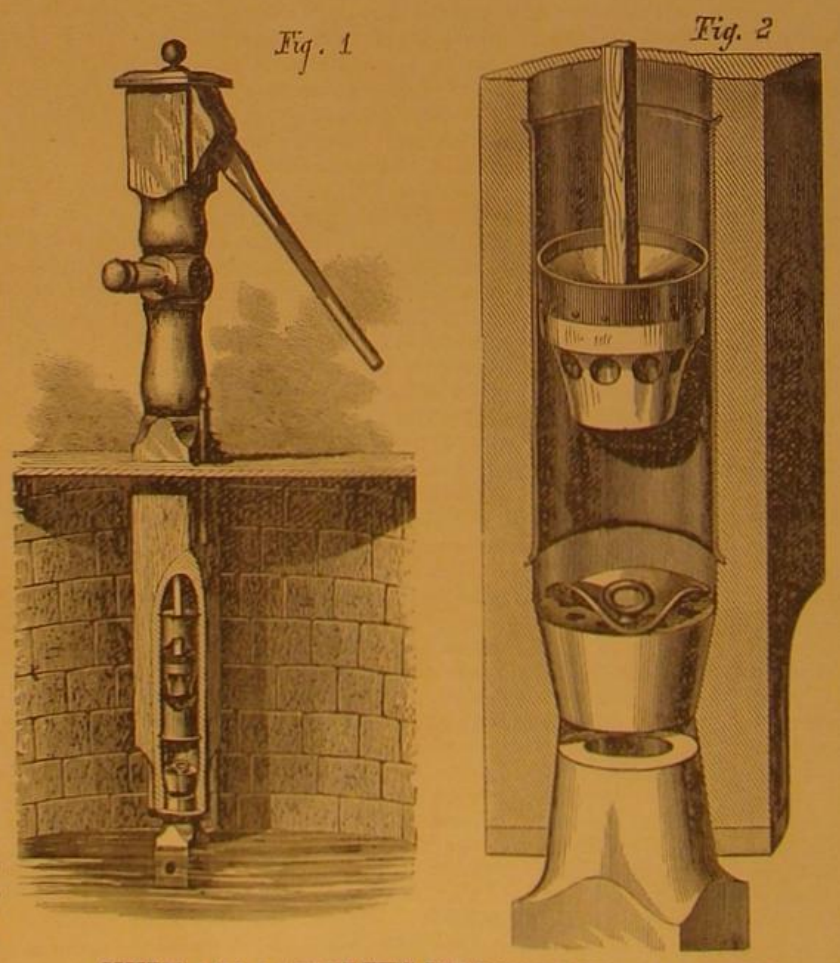
These machines can be constructed with any dimensions, to suit the magnitude of the work, provided the proper proportion of the parts be preserved for strength, motion, power, and durability—considerations very important for the success of any machinery, more particularly such as is supported on a floating foundation.

It is claimed that a machine of this kind, designed to raise 6,000 cubic yards per day, of ten hours, may be more economically worked than two designed to perform the same work, as all the help required to work the larger machine more than one of the smaller ones, would be that needed to dispose of the excavated material.

A machine capable of raising 3,000 cubic yards has been used by the Central American Transit Co., in the San Juan river and the harbor at its mouth, and is said to have worked with great satisfaction to the Company. Another, with some of the improvements described, was built in 1857, for the Corpus Christi Ship Channel Company, in Texas, with which the channel was finished to sixty-four feet in width, without the use of a lighter, except to support the long spout in which the excavated material ran off on an inclination of one inch to the foot.



HOWARD'S DREDGING MACHINE.



SMITH AND LAFFERTY'S IMPROVED WOODEN PUMP.

Wooden Pump

The wood pump has been so long in use, and is so well known, that, at first sight, it might seem hardly worth while to attempt its improvement, more especially as it now competes with a host of metallic pumps which have secured a widespread popularity. The wood pump has, however, the advantage of metal pumps on the score of cheapness, and it is claimed that the improvements herewith illustrated enable it to compete in all other respects.

The most prominent improvement is the placing in the pump a metallic spring lining, made of galvanized iron, copper, or other suitable material. The top and bottom of this lining —which is of sufficient length to give a bearing surface for the plunger—are turned out slightly, like the mouth of a trumpet, and forced into the wood. This holds the lining firmly in place. At the same time the vertical joint is so constructed that it allows the elastic spring lining to expand and contract, to compensate for the swelling and shrinking of the wood, so that it always fits the bore of the body of the pump. The plunger has also been improved. Its shape is distinctly shown in Fig. 2 of the accompanying engravings. It is made in a solid piece, curved holes passing through it so as to leave ribs between the holes, which serve to strengthen the plunger, the curvature of the holes being such as to give natural and easy flow to the water in passing through them. The top of the plunger is concave, and is covered by a corresponding leather valve, like that shown in the lower or check valve. This valve acts from the center outward, securing, it is claimed, greater rapidity and certainty in closing, so that, we are told, a gain of one fifth over the old valve is secured by a prompt stoppage of return flow. Both valves act as described, and this construction also prevents sand from preventing the closing of the valve. The seat of the lower or check valve is made tapering, as shown, and is provided with an eye in the center whereby it may readily be withdrawn from the barrel when desired.

The spring lining is also made slightly larger at the top than at the bottom, which permits the easy withdrawal of both plunger and check valve seat. The joints which connect the pipe to the pump barrel and the couplings of the wood pipe are made tapering, which secures not only a permanent and perfect fit, but a fit the whole length of the joint, instead of, as in the old method, an imperfect and short contact.

The length of the pump barrel is such that the working parts are placed below the reach of frost in the coldest weather, the water being vented just above the lining, so that although the upper part of the barrel is freed from water, the working parts remain immersed, and no priming is required in starting. The vent stopper is a flat bar of iron pivoted in the middle to the side of the pump, and having a leather packing at the lower end to cover the vent hole, the upper end of the bar passing up through the floor of the curb, so as to be readily opened or closed, and having its motion limited by stops attached to the pump barrel. These improvements are, we are told, so cheaply applied that the cost is but slightly increased over that of the less efficient old wooden pump.

Patented June 21, 1870, by R. M. Lafferty, of Three Rivers, Mich., and manufactured by Smith & Lafferty, of the same place, and by the Toledo Pump Co., Cleveland, Ohio, to either of whom orders or letters for further information may be addressed.

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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.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The Troy meeting commenced on the 17th of August, and closed on the 24th. It was a gratifying success; the proceedings were harmonious, dignified, and vigorous; many of the papers read are valuable.

The attendance was respectable, and all parts of the country were represented. But many familiar faces were not to be seen. Death has made sad havoc among the old men. Henry is in Europe; Agassiz and Peirce were kept away by sickness. There was, however, a crowd of earnest young men, of whom we name as examples the Salem naturalists, and Cope, Pickering, Hitchcock, Young, and Storer, who are ready (and who will, perhaps, some day be able) to take their places. Of course there were clap-trap, private ax-grinding, and speeches for Buncombe, and yet probably no more than at former meetings.

The Association is indeed one of the most important of living agencies for the advancement of science in America. Its list of members comprises nearly all the American names which are distinguished in scientific literature. It brings together harmoniously the members of all our other learned bodies, and thus it represents the science of the whole continent. The Association is a national institution, and it asks for the sympathy of all the friends of progress.

It is to us a very gratifying fact that the Association is respected and honored by the people at large. At the present time there is no other annual peripatetic convention which is so much invited, prepared for, talked about, and hospitably entertained; and all this notwithstanding its proceedings are as unintelligible as Greek to most of its kind friends. No one can see this and believe that America is justly reproached with neglect or distaste for scientific pursuits. If America is behind other nations in scientific advancement it cannot be because our scientific laborers need the stimulus of sympathy and appreciation.

As an example of how kindly the Association is treated we may mention some interesting facts about the Troy meeting. The citizens of Troy contributed $10,000 to defray the expenses of the entertainment. Hotels, private houses, and public buildings were freely opened for the use of the Association, and the members were honored as if they were guests of the whole population. Elegant receptions were given at the houses of the Mayor and of other leading citizens. The Association in a body, at the invitation of the Troy local committee, went in a special train to enjoy the elegancies of Saratoga, and, at the invitation of the State Department of Education and in a steamer chartered by citizens of Albany, visited the Capital.

The Association is, then, a very respectable society, and it receives the hearty homage of the people. The people surely contribute fully their part in the cause of science. Should not their liberality and hospitality be a stimulus to still greater exertion on the part of the Association? Does the Association owe a duty to the public, and is that duty well attended to?

Because we respect the Association so highly, we desire to see it improved if possible, and it is for the same reason we see its defects. In some respects it is better than it was before the war; it is more in earnest, and it has more workers; and in other respects it has sadly changed. There are lately more trashy papers, and especially papers which are made big with padding from encyclopedias and old almanacs. Perhaps it is impracticable to prevent such papers being offered, but there surely may be some way of keeping them out of the printed transactions. The printing of some of these papers recently, has made the Association an object of ridicule all over the world. Why not try to prevent such a thing happening again. A little quackery, boring, or ax-grinding, which lasts only during a meeting, is perhaps best to be endured, but print it in the transactions and it is a disgrace for all time.

THE ST. LOUIS BRIDGE.

The bridge now in process of erection across the Mississippi at St. Louis, is one of the wonders of the age. It is to be a tubular, cast steel, arch bridge, supported by the abutments and two piers; the latter are 515 feet apart, and 497 feet each from its nearest abutment, making three spans of about 500 feet each. Its greatest span is the same as that of the Kuilenburg bridge over the Leck, an arm of the Rhine, in Holland. Thomas Telford's suspension bridge across the Menai Straits, in the northwestern part of Wales, has a span of 570 feet. The Victoria tubular iron bridge of Montreal, exceeds this greatly in length, being 6,600 feet (1¼ miles), but it rests upon 24 piers, and its spans are only 275 feet. The Suspension Bridge at Niagara spans 821 feet, and is 245 feet above the water. The East River Bridge will span 1,600 feet, at a hight midway of 130 feet.

But the novel method of the construction of this bridge in some particulars, renders it especially worthy of note. The piers are sunk in the following manner: The masonry is commenced at the surface of the water, upon an inverted elliptical-shaped caisson, 80 feet long by 40 wide—the dimensions of the pier. This is closed at the top and open at the bottom, with its lower part larger than the upper, to facilitate its passage through the sand after it reaches the bed of the river. It would be very much like building the pier upon the bottom of an inverted wash-tub, of the same size and shape as the caisson. The caisson is filled with air, like a diving bell, and the mass of masonry which constantly accumulates upon it is borne up by the confined air, and, as the caisson descends, the pressure of the water condenses the air so that the water rises considerably within it, just as when an inverted tumbler is pressed down into a vessel of water. To prevent this and give greater buoyancy to the mass, air is forced into the caisson through a vertical passage in the masonry by a powerful steam pump. The caisson with its superstructure of masonry must be sunk to the rock bed of the river, because the deposit of sand above it—which at one pier is 79 feet deep—in times of flood and freshet, is scoured away to a great depth, if not to the rock itself. When the caisson reaches the river bed, the sand within it must be removed. This is done by a current of water that is forced down, by a tube, through the masonry, into the caisson and then up again to the surface; and as it takes its upward course the sand is shoveled into it through a contrivance for the purpose, and carried to the surface in the form of muddy water by the ascending current and poured out into the river. Here it causes a bank of sand to accumulate which sometimes rises to the surface of the water.

Workmen are needed in this caisson of condensed air, below the bed of the river, to shovel the sand and do other necessary work. These pass down by means of a circular stairway in another vertical passage—there being five in all—through the center of the pier, and are admitted into the caisson through an air-lock or chamber, with an air-tight door on the upper and lower sides. Into this chamber, after the men have passed the upper door, the condensed air is gradually admitted till it is as dense in the lock as in the caisson below. They experience here very peculiar sensations, among which are, a burdensome pressure upon the whole system and especially upon the drum of the ear, and a great increase of heat in the system, because condensed air has a smaller capacity for heat than in its ordinary state. In passing out, of course, the order of proceeding and of sensation is reversed. The workmen in the caisson are exposed to considerable danger from the unusual atmospheric pressure, which sometimes amounts to two or three atmospheres. Several have died from the injuries here received. When the caisson has reached the bed rock, the rock which "dips" towards the Illinois shore, is leveled off with concrete; then the caisson and the passages in the pier are filled with concrete, and the *solid pier* rests upon a foundation of limestone rock. Two piers have been sunk in this manner and are now above the surface of the water; the last will be similarly sunk this fall.

The manner of testing the steel which will form the arches of the superstructure is also very interesting. This is done by means of a massive machine which acts by hydrostatic power. By its use the power of the steel to resist both compression and tension is accurately determined. It is a well known principle of hydrostatics, that a given pressure upon one square inch of liquid surface causes equal pressure upon *every* inch of that surface. This instrument is so constructed that the surface where the power is exerted is to the surface of the piston where the power is applied as 1 to 100; hence the exertion of one pound of power produces a compressing or tensile force of 100 pounds. Any change in the length of the steel to be tested, even to the 20,000th of an inch, it is said can be detected. This change is indicated by a mirror, which revolves as the piston moves, and which reflects light from a graduated arc, 25 feet distant, to a telescope situated in the arc. Through this the observer looks and records the continued changes of the steel by the varied pressure to which it is subjected. Every piece is tested until its limit of elasticity is reached, that is, until it has become so compressed that it will not spring back when the pressure is removed. It may be subjected to a force of 100 tuns.

A WANT IN LOCOMOTIVE ENGINEERING.

We this week saw in an English paper a controversy in regard to the speed of a train in rounding a curve, it being charged that a "driver," as our British cousins style a man who runs a locomotive, was in the habit of taking a particular train around a curve above the standard speed of forty miles an hour, for which the curves are calculated, thus endangering the safety of passengers.

This question of speed always comes up when accidents occur, and as yet no adequate means have been adopted whereby the precise speed of a locomotive engine at any given point of its running can be so recorded as to settle such questions beyond dispute.

Such an instrument would be a boon to engineers who run locomotives, and who are, in our opinion, much more often unjustly than justly blamed for undue and improper speed on the occasion of accidents.

The problem is not a difficult one to solve. We once, as a matter of personal amusement, designed an instrument on the principle of the ball governor which would do it perfectly. The balls, instead of being hung on pivoted arms, slid out on horizontal arms against scale-springs of definite power, as they revolved by motion derived from one of the truck wheels. In doing this they raised a tracing point along the side of a vertical cylinder revolving by clock-work, making a mark of given hight for a given speed, rising with increased speed, and falling as the velocity of the locomotive decreased. Vertical lines on the surface of the cylinder represented hours and five minute divisions, and the position of the pointer between these lines might easily be computed for any less time than five minutes.

The general principle of this device is simply the conversion of rotary motion into pressure, and taking a diagram of the pressure at different points of motion, as is done with the steam indicator.

Doubtless inventors might greatly simplify this device, or it may be, adopting a different principle, succeed in devising something much better.

In these days of accurate measurement in everything pertaining to the use of steam it seems a little singular that a matter of such importance, in a scientific as well as a legal point of view, should have been so long overlooked.

In legal actions arising from accidents on railways the corporations are always placed at a disadvantage before juries, the latter always being inclined to sympathize with individuals rather than with the companies, who, it is thought, can better afford to pay, than the individual can afford to fail to recover the damages he claims.

The witnesses, also, are, many of them, totally incompetent to judge of the question of speed, and are mostly liable to overrate it. The adoption of such an instrument as we have described, or some other calculated to effect the same object, would obviate all disagreements of this character, and thus prove valuable to the corporations, as well as to those who hold the responsible posts of engineers.

THE SOUTHERN DEMAND FOR MACHINERY.

We find in the columns of the Kaufman (Texas) *Star*, an article calling attention to the changed condition of the South, and the pressing need of employing machinery to make up the existing deficiency in labor. That the minds of the most enterprising of the people are fully aroused to this need is evident from the many communications we receive in relation to it, and also from the fact that a very respectable beginning in manufacturing has been already made in some of the States.

The article alluded to gives some facts relative to the section of the State—Kaufman County—in which the journal above named is published.

These facts, as significant of the great want of machinery in various parts of the South, and that immense development which may be expected from its introduction, will be of interest to our mechanical readers, especially those engaged in the manufacture of wood-working machines.

This section is, like many other Southern sections, well stocked with valuable timber. The Bois d'arc fork of the Trinity River passes through the county, and the bottom lands constitute one vast forest of bois d'arc trees, two miles wide, and fifty miles long. These trees here attain to a diameter of from two to three feet.

The journal referred to states that this timber is the most durable in the world. It says: "We will venture the assertion that no living man ever saw the symptom of decay in this remarkable timber. The running gear of a wagon that has been in constant use over twenty years, is before us as we write this article, and yet the wood works are, to all appearance, as sound as when turned out of the shop. There is an oil in the wood which fills up the pores and prevents either air or water from affecting it. No one can tell how long it will last, even when exposed to the weather. A reward might be offered in vain, for a decayed particle of this timber. It is not affected by the rays of the sun, and hence it never shrinks. A carriage wheel made of bois d'arc will run until the tire is worn out, without having to set it. But the greatest evidence of the superior quality of this wood, for wagons and carriages, may be estimated from the fact that a rough home-made bois d'arc wagon is worth about double the best Northern-made wagon."

To make by hand twenty-four spokes of this timber has been considered a fair day's work. Four wagon hubs were also considered a day's work.

There are no doubt plenty of machines that will turn out these spokes at an average rate of one thousand per day, and which can be afforded for less than the cost of one man's labor for a single year. We are certain that machines are made which will turn out also from three to four hundred hubs of this timber per day. Indeed, the Kaufman *Star* informs us that a Northern firm offer to furnish spoke machines capable of making from twelve hundred to fifteen hundred spokes per day, for $250 each, and machines at the same price that shall make from four hundred to four hundred and fifty hubs per day, each requiring only one attendant, and the two doing more work than one hundred men could do without machinery.

It is easy to see how the introduction of such machinery into the region described would enable these hubs and spokes to be made for shipment to all parts of the country at a remunerative price, or even to be exported.

But Texas is not alone in the possession of timber treasures. Virginia, Georgia, North and South Carolina, and many other parts of the Southern States also can boast of very large tracts of valuable timber land, the most of which could be made to yield immense returns by the introduction of such machinery as has been for years employed in the timbered sections of the North. The cost of transportation after the raw material has been made into forms of increased value, is not materially more than for the shipment of the crude lumber, while it pays far better.

The manufacture of tubs, pails, chairs, sashes and blinds, and the great variety of wares which have made New England famous as a wood-working section, might, without doubt, be most advantageously carried on in the South, and our information of some few factories of this kind, which are now running in Southern localities is such as to greatly encourage the establishment of others.

PARAFFINE INDUSTRY.

In the Paris Exhibition of 1855 was shown a block of paraffine, with a few candles. Few visitors understood what it was, and no one could have anticipated the great extent to which the trade in this article would subsequently be pushed. The manufacture of paraffine candles has become an important industry, and there are single establishments in Germany capable of turning out 240,000 candles daily. In England and France the industry has reached vast proportions, and in this country it has no mean significance. Wagner estimates the production of paraffine in Prussia alone for the year 1870 at 11,000,000 pounds. The brown coal of Germany and the bog-head of Scotland and the Rangoon petroleum are particularly well adapted to the production of paraffine, while Bohemian and Austrian and other continental coals yield a very small quantity. The uses of paraffine are many. As its melting point is low it is proposed to employ it for the preservation of meat. Meat several times immersed in a bath of melted paraffine will keep for a long time, and when wanted it is only necessary to melt off the adhering wax-like coating to prepare it for cooking. For stoppers to acid bottles, to coat paper for photographic and other uses, as a lubricator, for candles, as burning oil, to coat pills, in the refinery of alcohol and spirits, paraffine now finds ready use. It has also been employed for the adulteration of chocolate and candies; for the preservation of railroad timber; to saturate filter paper for certain purposes; to coat the sides of vessels in which hydrofluoric acid was to be kept; to preserve fruit from decay; for oil baths of constant temperature; to prevent the oxidation of the protoxides; to render fabrics waterproof; as a substitute for wax in the manufacture of matches; as a disinfecting agent; as a varnish for leather, and for many other useful purposes. There are very few bodies that can attack or in any way decompose paraffine, and hence its great value in many chemical processes. Its use is likely to be further extended the more we become familiar with its properties, and it appears destined to assume an important position among our chemical industries.

CRAIK'S PRACTICAL AMERICAN MILLWRIGHT AND MILLER.

In our column of "New Books and Publications" will be found the notice of a book under the above title which deserves more than the ordinary notice; not that it has no deficiencies, or that it is characterized by scientific style and method, but that it embodies the results of a long and varied experience in the construction of various kinds of mills, an experience all the more valuable, as the author gives evidence in his pages that he is one of the comparatively rare individuals who can observe with discrimination, and draw accurate inferences. Perhaps no department of engineering demands greater fertility of resources than mill construction. Hardly any two mills are alike in circumstances of position, available power, and character of soil, upon which their foundations must be placed. Dams, also, require endless variety of detail according to the peculiarities of the beds of streams upon which they are erected. Varying heads of water, also, introduce further complications. In all of these particulars, and in many others, not specified, no amount of theoretical information can supply the lack of experimental knowledge; and next to such knowledge, personally acquired in practice, ranks that tersely and plainly communicated by such a man as the author of this work. The aim has not been to produce a scientific treatise. The work is rather an embodiment of practical results and tests of the various kinds of mill machinery under a wide range of circumstances, some of them "offering considerable difficulties and calling for great diversity of practice." The six chapters on water wheels are alone worth the price of the book. They however comprise only a comparatively small portion of the work, which is a large octavo, filled with practical information upon nearly every topic connected with the subject of mill building and running. The subjects of wind mills, their construction and adaptation to our Western prairie country, is of great interest, and is treated at length. The style of the work is such as any mechanic may understand, all algebraic formula being avoided, and the rules being simplified to the utmost.

Mr. Craik makes a statement in his discussion of the transmission of motive power, which is not correct. He says, "probably the greatest distance power was ever carried was by a combination of jointed rods used to connect a series of pumps with the water wheels which drove them, at the celebrated waterworks of Marli, near Paris, in France. Eighty-two of these pumps were placed more than three hundred feet above the power which drove them, and *half a mile away*." In Prof. Barnard's report upon the Paris Universal Exposition, on page 132, is an account of the successful transmission of power by Hirn's telodynamic cable, to a distance of nearly three and one eighth miles, at the mines of Falun, in Sweden. A short extract upon this subject, from the report alluded to, was published in our last issue.

But such an error as this is of little importance when compared to the great practical value of the work. In another part of the paper will be found an extract which is a fair sample of the plain, comprehensive character of the book, which we can confidently recommend to all who are interested in mill building and milling.

THE MILLENNIUM, OR SOMETHING LIKE IT.

We have, in another column, noticed the fact that the American Association for the Advancement of Science is forced occasionally to listen to papers containing nothing but twaddle, and that this twaddle, printed, redounds not to the honor of the Association at home or abroad.

Such, however, was not the character of the paper read by the well known scientist, thinker, and inventor of the "panatechner," Clinton Roosevelt, of this city. His paper discussed the question, "Ought a true science of national wealth to be excluded from the curriculum of the American Association for the Advancement of Science?"

If we may judge from the character of many of the papers read, the question as to whether anything should be excluded seems superfluous. But a superfluous question is often a splendid thing to string words upon, especially if in the stringing, the elegancies and accuracies of congruity, pertinence, terseness, perspicuity, and logic, are not considered essential.

To discuss the momentous question propounded by Mr. Roosevelt, was by no means a difficult task to one so rich in ideas, and so fertile and felicitous in diction. We were not present at the reading of *his* paper, but the report of it, published in the *Times*, gives evidence of its brilliant and exhaustive character. The assembled *savans* no doubt gave full expression to their delight when Mr. Roosevelt finished his paper. Being a polite set of men, they would not be likely to interrupt him by applause during the reading, however much the fullness of emotion might struggle for utterance.

Mr. Roosevelt was willing to allow, according to the motion of Professor Agassiz, made at the last annual meeting of the Association, at Salem., Mass., that the system of political economy, as taught in our colleges and universities, embracing only production, distribution, exchange, and consumption of articles having exchangeable values, is insufficient to embrace a true science of national wealth. In his view the science of national wealth consists of three orders and nine genera, without counting the species, varieties, etc.

Surely the *savans* cannot refuse to seize upon a subject involving three orders, nine genera, and an indefinite number of species. Such a field as this to enter in upon and take possession of! A veritable scientific Canaan, flowing with philosophic milk and speculative honey, and bearing choice fruits of endless discussion and debate! Surely, they each and all exclaimed in their hearts (being too polite to speak in meeting), "*Here's* richness! Here's *Richness!*"

According to Mr. Roosevelt, "the reason why all systems of government by reason alone, have failed hitherto to make peace on earth and good will to all, is that the will of man is not governed or to be governed by the greatest motives, but by the same general law that governs in physics; thus accepting the science of government as the science of motive powers. Motive powers are of two kinds, metaphysical and physical. And whereas, in physics motive powers operate directly as the substance, and inversely as the squares of the distances in space, in metaphysics motives govern the will of man in times. Thus men who verily believe in eternal rewards and punishments still give way to the present temptations, and fear little practically, until death or the instrument of punishment comes near. Thus, as in the State of Wisconsin, the La Crosse and Milwaukee Railroad Company bribed all at once the Legislature, the Judiciary, and the Executive, and left the people as so many sheep without a shepherd; so has it always been."

As a specimen of much in little, we commend this passage as a model for very young students of English composition. Much words and little sense is a style that pays well in modern literature, as most contributors to our magazine literature are now paid by the column.

"The same things, which, if left alone, are destructive to life and happiness, if removed, become beneficial in their proper places; as the offal of cities left to find its own level in the lowest places, sends forth malaria, disease, and death, if transported to the surrounding country and covered in the soil produces flowers, fruits, and cereals for the support of life and happiness; that there is a law of Providence under the higher law of absolute necessity in the nature of things; that what a man or nation will not labor or fight to gain and guard when gained, shal' not be enjoyed."

This passage is copied verbatim from the *Times'* report. It doubtless means something, and if it were not too late, we would suggest that the Association should appoint a committee to ascertain the meaning, correct the grammar, and report at their next meeting whether it should be admitted into the curriculum of the Association, or not.

At the same time, Mr. Roosevelt's orders, genera, and species might also be distributed among the members—a priceless boon, since, according to that gifted thinker, they comprise "all that man can reasonably desire on earth, as useful or delightful to him"—a millennium, or something like it.

Mr. Roosevelt is especially hard on the free-traders, putting them into the same category with "free-lovers" and "free-booters." We don't see how they are going to stand this violent attack, which, following Mr. Greeley's *Tribune* essays on political economy, is, like charging, after a battle, upon the dead and wounded—to say the least—ungallant of Mr. R. He might, indeed he might, have let the free-traders alone, and confined his remarks to the physical and metaphysical motors which run railways and legislatures. How easy it would have been to have pilloried Prince Erie on his metaphysical motors, Fisk's Opera House, Camp Jay Gould, and an unlimited grab from the pockets of the Erie stockholders, not to mention Fisk himself, the most metaphysical motor on this continent.

But we reluctantly leave Mr. Roosevelt's paper, from the reading of which we have become better, wiser, and more able to grapple with the hard problems of social science. When in due time the transactions of the American Association for the Advancement of Science shall appear, it will be demonstrated to the world that he who advanced it most, during the year 1870, was Clinton Roosevelt, Scientist, Thinker, and Inventor of the Panatechner.

THE ANALYSIS OF MILK.

Dr. Chandler, of Columbia College, has recently been paying attention to the analysis of milk in connection with an examination of the milk vended in this city. The results of his examination having been published, the method adopted for the analysis of milk in so far as its adulteration by water is concerned, has met with criticism from the pen of Dr. A. E. Davies, in the *Chemical News*. As the short article of Dr. Davies not only gives the method employed by Dr. Chandler to ascertain the amount of adulteration by water, and the reasons why it is considered defective, but adds a method considered much more exact, we copy the whole of it. The method is one that can be easily and generally applied, and will be found of use in the numerous cheese factories established during the past few years in this country.

Dr. Davies says:

"As to water being the only substance which is employed for adulterating milk, I perfectly agree with Dr. Chandler. Carbonate of soda and nitrate of potash are occasionally added, but only rarely, and in very small quantity. I have never met with chalk, sheep's brains, mucilage, sugar, etc., in any sample which I have analyzed.

"Since water, then, appears to be practically the only substance fraudulently added to milk, it is a matter of the greatest importance that we should be able to detect the presence of added water, and to estimate, at least approximately, its amount. This (at least the presence of added water) Dr. Chandler considers may be done by taking the specific gravity of the milk and estimating the water it contains by evaporating a weighed sample to dryness. 'Pure milk,' he says, 'varies in specific gravity from 1·023 to 1·032, water being represented by 1·000.' And, again, 'It is found that good milk generally has a specific gravity of from 1·029 to 1·032. In testing milk, the lower number is selected as a fair gravity for pure milk; and whenever the gravity falls much below this the milk may be considered as containing an excess of water, and consequently poor in quality or adulterated.'

"Now, according to my experiments, the specific gravity cannot be at all relied on as a test either of freedom from adulteration or of natural richness. I give a single example. A sample of milk of known genuineness recently analyzed by me gave the following results: Casein, 4·26; fat 6·26; sugar, 5·13; salts, 0·60; water, 83·75; cream (by the lactometer), 17 per cent; specific gravity, 1·0246. It was, therefore, a very excellent sample, and rich in all the solid constituents of milk, especially butter, but had it been judged by its specific gravity, it would have been put down as of very inferior quality. Besides, even supposing the specific gravity to be a reliable test of quality, it gives us no indication as to whether the milk is naturally poor or has been rendered so by the addition of water, and the test, in my opinion, is therefore worthless.

"As to the estimation of the amount of water by evaporation, Dr. Chandler says: 'A perfectly reliable method, though more laborious, is to actually determine the percentage of water in the milk, by evaporating a weighed quantity and carefully drying the residue at 212° Fah. If a milk loses more than 88 per cent of water, leaving less than 12 per cent of solids, it may safely be pronounced to be adulterated.'

"From this view, I totally dissent; the presence of 88 per cent of water is an indication of inferior quality, but is certainly no indication whatever that water has been purposely added. In milk of known purity, examined by Dr. Voelcker, as much as 90·70 per cent of water was found; and this alone shows the untrustworthiness of Dr. Chandler's test—at least, as far as it refers to added water.

"It appears to me, that what is wanted is, not a test which will simply tell us whether or not the milk contains more than the normal quantity of water, without giving any indication whether the water has or has not been added to the milk. If this were all, the estimation of the water, by evaporation, would accomplish it; but, what really is required, is a test which will show if the milk has been purposely diluted with water, and, if so, what quantity of water has been added. Such a test, I believe, we have in the specific gravity of the serum, or liquid portion of the milk, from which the casein and fat have been removed by coagulating and straining. The gravity of this liquid I have found to be remarkably constant, ranging, in that obtained from genuine milk, from 1·026 to 1·028; and, by carefully ascertaining the specific gravity of the serum of genuine milk diluted with various quantities of water, we may obtain a standard of comparison which will enable us to say, within a few per cents, what quantity of water has been added to any sample of milk that may come under our notice."

DIVISIBILITY OF MATTER AND SIZE OF CHEMICAL ATOMS.

Atoms as indivisible material elements of unchangeable form, size, and weight, are a convenient hypothesis conceivable in so far as the properties above enunciated are concerned. But any attempt to conceive of them as they really are is futile. Even if we could by improvements in optical instruments render them visible and demonstrate their existence by actual sight there would still be inconceivable things about these seen atoms, differing, as they would, from all other things that we can see, and from each other, not only in size and weight, but in qualities, of which we can have no conception, but which are inferred to exist from the chemical comportment of the elements to each other.

A correspondent has asked in what solution is the extremest division of matter apparent, and the nearest approximation to the size or bulk of the atom made. The first part of this query may be answered; the second is unanswerable, because the size of neither the atomic or molecular intersticial spaces are yet determined, so that if we could determine that a definite number of atoms were mingled with a given number of atoms of another kind we should still lack data for any estimate of their relative size. Assuming them to be spheres with their sides in absolute contact, such a calculation might be made, but all we know of the various states which matter assumes teaches that they do not touch each other.

To answer even the first part of the query would, however, require much research. We shall content ourselves with giving some remarkable instances of extreme divisibility. One three-hundred-and-sixty millionth of a grain of gold may be seen by the use of a microscope magnifying 500 diameters. A grain of copper dissolved in nitric acid will, upon addition of ammonia, give a blue tint to 392 cubic inches of water; one three-hundred-and-ninety-two millionth of which may be seen by the aid of a microscope. The ammonia contained in a small drop of water may be detected though only one part in two hundred thousand by the use of chloride of mercury.

Thompson, the celebrated physicist, has lately been performing a very interesting calculation with a view to determine approximately the size of atoms, the calculation being based upon the phenomenon of capillary attraction, the work performed in overcoming the contractile force of soap bubbles, the kinetic theory of gases (first suggested by Bernouilli, and since worked out by Herapath, Joule, Clausius, and Maxwell), together with the laws of optical dynamics. As the result of these calculations, he concludes that the diameter of gaseous molecules, or atoms of elmentary gases, are not less than 0·0000000007942 of an inch. How much larger than this they may be, he does not tell us in numbers, but he does say that, if a drop of water should be magnified to the size of the earth, and each molecule magnified in the same proportion, the molecules would even then be smaller than cricket balls.

ENTERPRISING JOURNALISM.

The Atlantic Cable dispatch containing a full account of the great battle of Gravelotte sent to the New York *Tribune* and published in that paper on the 24th ult., is probably the longest and most costly dispatch ever sent over the transcontinental wires. It cost the *Tribune* $2,260 in gold. As a specimen of enterprising journalism this is absolutely unprecedented, but it may be surpassed ere the war closes. The slow moving dailies of London and other foreign cities will stand wide-mouthed with astonishment at the absolute disregard of expense shown by their American cotemporaries in obtaining news. We doubt whether any of them ever paid as much for news in an entire week as the *Tribune* paid for this single dispatch.

$20,000 BONUS FOR A NEW PRESS.

The circulation of the New York *Sun* has become so enormous that the publisher, Mr. I. W. England, finds it almost impossible to print the edition. Five presses are now employed for that purpose, but the utmost capacity of either is only equal to printing 17,000 copies per hour.

Mr. England wants a press that can strike off 40,000 copies per hour, printed on both sides, and he authorizes us to offer a bonus of $20,000 for such a press—one that will do its work well. This question of more rapid printing is one that must engage the earnest attention of our inventors, and it seems that the tendency of the *Sun* is in that direction.

THE School of Mines, of Columbia College, will re-open on Monday, Oct. 3. The announcement of Dean Chandler appears in our advertising columns.

SCIENTIFIC INTELLIGENCE.

FUORIDE OF SODIUM.

This valuable reagent can be made on a large scale by fusing 100 parts fluor spar, 140 parts of carbonate of lime, 200 parts of sulphate of soda, and an excess of carbon. The fluor spar is completely decomposed, all of the sulphur remains with the lime as sulphide of calcium, and the flux yields a colorless, pure solution.

The difficulty of obtaining a sufficient amount of material has prevented an extensive use of the fluoride of sodium, but now that it can be easily made it ought to attract more attention. It could be advantageously used for the resolution of many silicates, as it forms insoluble double salts with some of the sesquioxides, and in this way the soluble protoxides could be removed. Take, for example, the beryl, by treating it with fluoride of sodium, the aluminum would combine with the soda to form the insoluble double fluoride of aluminum and sodium (cryolite) while the glucina would be separated in an insoluble state.

Feldspar, treated in a similar way, would, no doubt, leave the potash in an available state, while the aluminum would form insoluble cryolite with the sodium. Fluoride of sodium would prove a valuable flux and reagent in the laboratory.

PLATINIZING GLASS.

R. Bottger recommends the following process: Pour rose mary oil upon the dry chloride of platinum in a porcelain dish, and knead it well until all parts are moistened; then rub this up with five times its weight of lavender oil, and leave the liquid a short time to clarify. The objects to be platinized are to be thinly coated with the above preparation and afterwards heated for a few minutes in a muffle or over a Bunsen burner.

This recipe is much simpler than the one given by us some time ago, and can be easily tried by any one. In order to recover the platinum from defective or broken glass, moisten with hydrochloric acid, and touch the spot with a zinc rod, when the platinum will fall off in thin leaves.

WRITING INK.

According to R. Bottger, a very good copying ink can be prepared as follows: Pulverize 30 grammes of extract of Campeachy wood and 8 grammes of crystallized carbonate of soda, and pour on 250 cubic centimeters of distilled water, and boil until the liquid has assumed a deep red color, and the extract is fully dissolved. Then remove the vessel from the fire, and add, with constant stirring, 30 grammes of glycercin of specific gravity of 1·25, and also 1 gramme of the yellow chromate of potash, previously dissolved in a little water, and 8 grammes of finely-pulverized gum-arabic, also previously moistened with water, and the ink will then be ready for use. This preparation will keep indefinitely in well-stoppered bottles, and there is nothing in it to attack the pens. Manuscripts can be copied by it without the aid of the press, by simply moistening the paper and using an iron knife or the thumb nail. The carbonate of soda prevents the gelatinizing of the ink, and the glycerin is a substitute for the sugar formerly employed.

TO DETECT THE AGE OF HANDWRITING.

Attempts have been made to invent a method for approximately determining the age of any writing. Iron inks suffer a change in process of time, and become yellow, the organic constituents disappear, and the iron becomes more prominent. By moistening the writing with weak hydrochloric acid (1 acid, 12 water) if the ink is old only a faint copy can be obtained, and the newer the writing the plainer will be the copy.

In experiments made by Carre, handwriting 30 years old gave scarcely any impression—an authentic document from the year 1787 yielded mere traces. Soaking the paper in weak hydrochloric acid gives opposite results, as handwriting a few months or a few years old is at once removed by the acid, while old ink has suffered such a chemical change that the acid no longer acts upon it. After the experiment it is well to neutralize the acid by suspending the paper over a capsule containing sal ammoniac. The test appears to be only applicable to writing several years old, and is confined to iron inks.

TO RENDER PAPER WATER-TIGHT.

The ammonia oxide of copper is a solvent for silk, paper, and cellulose. If its action be limited to a few moments it converts the surfaces into a gelatinous mass, and Scoffern proposes to employ this property to render the paper water-tight. If in the mill the endless sheet of paper is made to pass at a proper velocity through the ammonia copper solution, and is afterwards dried and pressed, the surfaces will be converted into a species of parchment, and will be water-tight. The rate of speed for the rollers must be a matter of experiment.

LIQUID GLUE.

Experience has shown that glue undergoes a chemical change when dried in the air, and its adhesive properties are decidedly deteriorated. To avoid this, says Prof. Wagner, in his report for 1869, some of the manufacturers have introduced a pure liquid glue in close packages, which is said to be superior to the dry article. It is prepared by digesting bones in a peculiarly constructed apparatus, and is sold according to a fixed specific gravity, so that the purchaser does not pay for the water, which in dry glue sometimes amounts to 12 per cent. The price is also less than for dry glue.

CEMENT FOR IRON AND STONE.

Glycerin and litharge stirred, to a paste, hardens rapidly, and makes a durable cement for iron upon iron, for two stone surfaces, and especially for fastening iron in stone. The cement is insoluble, and is not attacked by strong acids.

HIGHT AND WEIGHT.

[Condensed from Nature.]

One of the earliest efforts made to obtain anything like a fixed relation between hight and weight was that of Dr. Boyd, who weighed a certain number of inmates in Marylebone Workhouse. He took the hight and weight of 108 persons laboring under consumption, and found they measured 5 feet 7 inches, and weighed 90 pounds. He then measured and weighed 141 paupers who were not consumptive, and found that their average hight was 5 feet 3 inches, and that they weighed 134 pounds.

This subject attracted the attention of the late Dr. John Hutchinson, and he determined to take the hight and weight of all classes of persons in the community. In this way he collected the hight and weight of upwards of 5,000 persons. This list, however, included persons who exhibited themselves as giants and dwarfs, and other exceptional cases. He therefore reduced his instances to 2,650 persons, all of whom were men in the vigor and prime of life, and included sailors, firemen, policemen, soldiers, cricketers, draymen, gentlemen, paupers, and pugilists. This group of cases was intended to make one class as a set off against another, so as to get a fair average.

The following is the result of Dr. Hutchinson's observations:

Hight.		Weight.	Hight.		Weight.
Ft.	In.	lbs.	Ft.	In.	lbs.
5	1	129	5	7	148
5	2	136	5	8	155
5	3	133	5	9	162
5	4	139	5	10	169
5	5	142	5	11	174
5	6	145	6	0	178

Of course the result of these investigations of Dr. Hutchinson can only be considered as approximative, and he himself thought that a larger number of observations would lead to a more perfect law. The fact is, his observations are quite sufficient to establish all that we need, and to show that among a certain set of healthy men his estimate of weight and hight may be regarded as an approach to a healthy standard. It is only where considerable departures from the estimates given by Dr. Hutchinson take place that any particular case demands attention.

If the table is examined, it will be seen that the increase in weight for every inch of hight is a little more than five pounds. In fact, allowing for any error in observation, we may say that Dr. Hutchinson's table is reducible to the law that for every inch of stature beyond 5 feet 1 inch, or sixty-one inches, a healthy man increases five pounds for every inch in hight. If this deduction be accepted, we may very much simplify Dr. Hutchinson's table, and say that, as a rule, a man's weight increases at the rate of five pounds for every inch of hight, and this rule holds good for all practical purposes.

Although this law is approximately good for a certain number of cases, even above and below this table; it is practically found, and especially in the case of children and growing persons, that there is a wide difference of weight at hights below 5 feet.

Attention may also be drawn here to the fact that there will constantly occur in the community instances of persons where either the muscular or bony systems are excessively developed, and who consequently weigh more or less than their hight.

Dr. Chambers gives the hight and weight of certain celebrated prize-fighters, the result of Mr. Brent observations, which makes it very obvious that in certain cases the great weight depends on muscular and osseous development.

	Hight.		Weight.
			lbs.
Perrins	6	2	238
Caunt	6	2	213
Spring	5	11	185
Jackson	5	11	206
Bendigo	5	9	168
Johnson	5	8	187
Slack	5	8	191
Mendoza	5	7	172

The conclusion we come to with regard to these weighings and measurings is that all ordinary departures from the average hight and weight of the body deduced from Dr. Hutchinson's tables are due either to an increase or decrease of the fatty matter or of the adipose tissue in the body. Thus, taking the composition of a human body weighing 154 pounds, and measuring 5 feet 8 inches, it will be found that it contains 12 pounds of fat. It is then mainly due to the diminution or increase of this substance that human beings weigh more or less than the standard weights given in the above table. It will be therefore here worth while to inquire what is the use of fat in the system, and what indications are afforded by the hight and weight of the human body for caution in diet and regimen.

The exact way in which fat is produced in the tissue of plants and animals is not known, but there is evidence to show that it is found very generally in the tissues of plants and especially in the seeds. Oil when used for commercial purposes is mostly obtained from the seeds of plants, as seen in castor oil, rape oil, linseed oil, cocoa-nut oil, palm oil, and a hundred others. As it is found in the seeds of plants, so it is found in the eggs of animals. The embryo of all animals is developed in contact with oil, of which we have a familiar instance in the yelk of the egg of birds. It appears also that the muscular and other tissues grow under the fostering influence of the adipose tissue.

Besides this primary influence on the growth of the body, fat subserves many other purposes. In the first place it seems to be a reserve of material for producing muscular force when needed. Animals grow fat in summer, but as the supply of this material becomes scanty in winter

they lose their fat and get thin. Man himself gets fat in summer and grows thin in winter from the demand on this store for heating purposes. Hybernating animals go to their winter sleep sleek and fat, but wake up in the spring lean and meager, from the loss of fat in maintaining the animal heat necessary for life. Fat is thus seen to be an essential of animal life. Where there is too little deposited for the purposes of life, then serious disease has already commenced or may set in; while on the other hand a redundancy of this deposit may seriously interfere with the functions necessary to life.

It is from this point of view that the value practically of a knowledge of the hight and weight of individuals becomes apparent. When the weight of a person is much below his hight, then it may be suspected that some disease has set in, which may go on to the destruction of life. One of the earliest symptoms of consumption, the most fatal disease of the civilized inhabitants of Europe, is a tendency to loss of weight. Long before any symptoms are present of tuberculous deposits in the lungs, this loss of weight is observable in persons afflicted with consumption. And at this stage a large amount of evidence renders it probable that the fatal advance of this disease may be prevented.

Within the last thirty years a practice has been resorted to with great success of administering to persons losing weight and threatened with consumption, cod-liver oil, pancreatic emulsion, and fatty substances, as articles of food, for the purpose of preventing or arresting the tendency to loss of fat, which obviously results in the production of fatal disease. In fact, it may be stated generally, not without exceptions, that wherever the weight is much below the hight, there the commencement of dangerous disease may be suspected, and precautions taken to prevent the loss of fat. That this treatment has been successful in really preventing disease, and loss of life as the consequence, is the conviction of a host of intelligent practitioners of medicine. At the same time, it should be remembered that it is not only necessary in these cases to administer cod-liver oil or pancreatic emulsion as medicines, but that the consumptive should have recourse to a fatty diet, and should eat butter, cream, cream-cheese, fat and fatty articles of diet.

Obituary.—Samuel V. Merrick.

It is with great regret that we are called upon to record the death of Mr. Samuel V. Merrick of Philadelphia, Pa., the Founder and President of the Franklin Institute, and for many years an esteemed client of this office. A man of inflexible integrity, liberal culture, and great business capacity, he has for a long time been one of the most honored of the citizens of Philadelphia. His connection with the Franklin Institute has made his name familiar to the scientific world.

A meeting of the Board of Managers of the Institute was held to notice his death, and a series of highly complimentary resolutions were passed in relation to the character and acts of the deceased.

We also notice the recent death of T. A. Wasson, the well known car builder, at Springfield, Mass.

Province of Quebec Fair.

The Province of Quebec Fair of 1870, will be held at Montreal, Sept. 13, 14, 15, 16. $15,000 prizes.

American exhibitors are admitted on the same footing as Canadians. An entrance fee of one dollar covers all entries and entitles the exhibitor to four tickets to the grounds. Custom duties to be refunded. It is expected that American manufacturers, stock breeders, etc., will be fully represented. Entries for implements, etc., on or before the 3d September. For further particulars apply to the Secretary, Council of Agriculture, Montreal.

Ridicule.

Sometimes our correspondents make the mistake, in their replies to published letters, of attempting to heap ridicule upon the opinions expressed by other correspondents who happen not to agree with their theories. We are obliged to decline all such letters. Abuse is one thing, fair criticism is quite another, and the latter only is acceptable to us.

Watering Streets with Saline Solutions.—It is stated that, of the two deliquescent salts which have been applied for this purpose—viz., the chlorides of magnesium and calcium—the last-named suits best, the quantity being adjusted at one half a pound per square yard. In 1860 and 1863, the Place Bellacour, at Lyons, France, was (experimentally, and during great heat) watered with a mixture of chloride of calcium and commercial hydrochloric acid, properly diluted in water, the effect being highly appreciated by the inhabitants also on account of the perceptible purification of the air.

How perfectly almanac makers hit it, was verified in the weather word in one of the almanacs against the second Sabbath in August. "Scorching," was its prophecy. It was about the only Sabbath that was not scorching, and was the only one to which it applied that epithet. Thick clothes were its uniform. The almanac guessers should employ better mediums.

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.

In the year 1811 Kirchoff, a celebrated German chemist, discovered that it was possible to convert starch, by means of sulphuric acid, into sugar.

New Books and Publications.

On Microscopical Manipulation. Being the Subject-Matter of a Course of Lectures Delivered before the Quekett Microscopical Club, January–April, 1869. By W. T. Suffolk, F.R.M.S. Illustrated with forty-nine Engravings and seven Lithographs. Philadelphia: J. B. Lippincott & Co.

The microscope and the spectroscope are now leading the way to the interpenetralia of Nature's profound mysteries. Not that when all that human mind and human hands can do has been done there will remain nothing mysterious, we look for no such consummation; but to these instruments science is indebted for keys by which it has been enabled to enter whole realms of facts utterly inaccessible without them. But these keys are of but little value unless used in the proper manner. Fortunately for those unskilled, the manipulations necessary to success in microscopy, can be so described in books that an intelligent person may practice the most of them after a few attempts. But that this desirable result shall be attained it is necessary that the book upon which he relies for guidance be prepared, not only by one who understands the use of the microscope in its most approved forms, but is able to convey his knowledge and experience in plain unmistakable language. The book under present consideration is written by a man who ranks high among the many accomplished English microscopists. This is a sufficient guarantee that his knowledge and experience are ample for the task he has undertaken. The pages of the book bear the evidence of his ability as an instructor. The book contains seven chapters, with an appendix and notes, containing full information upon the construction of the instrument, its various parts, their uses, and adjustments; the mechanical processes of glass cutting, drilling, bending, and working of tubes; how to select the various tools and implements, and to keep them in perfect order; how to mount objects dry, in balsam, and in fluid; illuminating apparatus, comprising all the most approved devices for this purpose; polarized light, and its uses in microscopic examination; drawing and micrometry, etc.; six lessons upon the examination of various representative substances, with notes upon various collateral subjects connected with the art of microscopy. The work is handsomely printed and bound, and is really the most practical and complete manual for beginners in this delightful field of science we have ever met with.

The Practical American Millwright and Miller. Comprising the Elementary Principles of Mechanics, Mechanism, and Motive Power, Hydraulics and Hydraulic Motors, Mill-Dams, Saw Mills, Grist Mills, the Oat-Meal Mill, the Barley Mill, Wool Carding and Cloth Fulling and Dressing, Windmills, Steam Power, etc. By David Craik, Millwright. Illustrated by numerous Wood Engravings and Folding Plates. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut street. 1870. Price, by mail, free of postage, $5·00.

See notice in editorial columns.

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.

M. G., of N. Y., asks whether there would be any power gained by placing a turbine wheel higher in the draft-box—or tube which conveys water to the wheel—than the hight to which atmospheric pressure will sustain a column of water in a tube from which the air is exhausted, at the locality in which the wheel is placed, say, as an outside figure, thirty-three and one third feet above the tail water. We answer, that as all the water below the wheel can do, is by its weight and motion in falling to overcome the pressure of the atmosphere against the flow of the water through the wheel (the same as the condensation of steam in the steam engine removes the pressure of the atmosphere from the advancing piston), it is evident that when the wheel is placed at a hight sufficient to secure this action below the wheel, nothing can be gained by placing it higher. On the contrary, loss must result, from the diminished head above the wheel. In fact there can be no gain in placing the wheel above the level of the tail water, although it may for convenience be raised, without loss, within certain practical limits, varying somewhat with circumstances, but always less than the theoretical hight above specified.

T. S. K., of Ill., and several others, write in regard to the balancing of shafts and pulley systems, all agreeing that pulleys should be balanced separately, if they are to be run together, and also that the heaviest sides should be placed opposite each other on the shaft, so that centrifugal force shall act equally on opposite sides. This would not of course work where the number of pulleys is odd, and each required balancing; nor would it answer in all cases where the number of pulleys is even, as some may need more counterpoising than others. Most agree that the shaft should be large enough so as not to spring by the tension of the belt. One correspondent, however, erroneously thinks this of little consequence. For ourselves, we still adhere to the opinion that where pulleys have wide faces, and thin rims, they should have more than one spider, and the spokes ought also to alternate, so as to prevent springing of the rim. We also would make the arms of the spider straight and radial, instead of bent, or tangential to the hub, as is often done, as we believe a pulley unevenly weighted at the rim, and running at high speed, will maintain its shape better with straight, radial arms.

W. H. S., of Va.—Thin rubber, of the kind you describe, and used for tying over the tops of jars, as well as for other purposes, may be obtained at all the dealers in rubber goods. It is, however, not wholly impervious to water when long immersed, and gases will also pass through it. It will not do to seal fruit jars in this way, unless the fruit be preserved in sugar, "*pound for pound*," according to the old rule, in which case a loose cover will be as serviceable as the rubber.

J. D. B., of Pa.—It is impossible, without knowing the exact consistence of the varnish you have invented, to advise you what material added to it will make it dry more rapidly. If the vehicle is alcohol, it ought to dry quickly without such addition; if siccative oils are used, acetate of lead or litharge will make it dry quicker.

H. B. D., of O.—Wheels for ordinary canceling presses are made of composition, and cannot be used for perforating. Perforating stamps should be made of steel, and hardened, and it is better to make the figures separate, and set them in, so that in case of falling or breaking, they can be taken out and replaced.

H. W. G., of Mich.—To clean brass or silver, and polish the same, use aqua-ammonia and rotten stone, followed by rouge, applied with soft leather.

D. S., of Md.—The steam plows in use in this country are very few, and, so far as we know, have been imported from England. We do not think they can be obtained in this country.

F. H., of N. Y.—What is called "lodestone" is simply a species of magnetic iron ore.

G. L., of Kan.—We cannot give you the address of an emery and crocus cloth manufactory.

S. S. H., of Ala.—English flint glass expands 1 part in 1,248 in length, and 1 part in 416 in bulk, in heating from 32° Fah. to 212°. Brass expands under the same treatment 1 part in 526 in length, and 1 part in 179 in bulk. Iron, 1 in 846 in length, and 1 in 282 in bulk. These substances will expand nearly in the same proportions for higher temperatures below the point of fusion. Brass melts at 1,600° Fah. Iron at from 1,900° Fah. to 2,910°. Glass requires a very high temperature to fuse it to anything like fluidity. It, however, becomes soft and plastic at a red heat. It varies much in this respect, according to composition, that containing soda being more fusible than those containing potash.

J. F. G., of Mass.—In computing the power and resistance that will produce equilibrium in hydraulic presses or accumulators, it is the *areas of pistons only* that is taken into account, the areas of the supply pipe sections have no bearing upon the subject, other than that if too small they will increase the friction.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices 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

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.

Wanted—A good Steam Engine of from 80 to 100-H. P. Address, with particulars, Box 1969, New York.

Every Reader of the Scientific American, who will send his address to S. R. Wells, 389 Broadway, New York, with 15c., will receive a specimen of The Phrenological Journal, a first-class Family Magazine published at $3 a year, 30 cents a number.

John Dane, Jr., Newark, N. J., builds the best Hand Lathes, slide rests, presses, all kinds, Jeweler's rolls, models, dies, all kinds of light machinery and work, to order. Send for circular.

Six new and perfect Automatic Gas Generators, Wood's Patent at a low price. Or will sell the air pumps alone. Address David Street, 273 Franklin st., Cleveland, Ohio.

Owners of Worthington Pumps can hear of something to their advantage by addressing Jno. Clark, Water Works, Harrisburg, Pa.

Crampton's Imperial Laundry Soap, washes in hard or salt water, removes paint, tar, and grease spots, and, containing a large percentage of vegetable oil, is as agreeable as Castile soap for washing hands. "Grocers keep it." Office 84 Front st., New York.

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

Wanted—Salesman in the mechanical branch of business. Only experienced need apply at S. Firuski & Co.'s, 20 Cedar st., New York.

See advertisement on New Work on "Soluble Glass," published by Dr. L. Feuchtwanger, 55 Cedar st., N.Y. Price $3·12, mailed free.

Dickinson's Patent Shaped Carbon Points and adjustable holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24th, and Nov. 20, 1869. 61 Nassau st., New York.

Peck's patent drop press. Milo Peck & Co., New Haven, Ct.

"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.

A Good Machinist, with about $3,000, can have an interest and entire charge of a paying manufacturing business Address Machinist. Box 507, Baltimore, Md.

Tools and Machines for special uses built to order. Chas. N. Trump, Port Chester, N. Y.

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.

Gatling Guns that fire 400 times per minute are now made at Colt's Armory, Hartford, Conn. Send for pamphlets.

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-ton 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. H. 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.

Facts for the Ladies.

I have used one of Wheeler & Wilson's Sewing Machines(No. 2,762) nearly fourteen years, making cloaks for the last eleven years, and doing all other kinds of sewing down to book muslin. It is now in perfect order,has never had any repairs, and I have not broken a needle since I can remember. I appreciate my machine more and more every day, and would not exchange it for any machine that I know. M. DUDLONG.
Utica, N. Y.

Recent American and Foreign Patents.

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

HORSE HAY RAKE.—James M.Colson, Morrill, Me.—This invention has for its object to furnish an improved horse hay rake which shall be simple in construction, easily operated, strong, durable, not liable to get out of order, and effective in operation.

GRASS-SEED SEPARATOR.—D. B. Dixon, Unionville, Mo.—This invention has for its object to furnish an improved device for separating and preserving the seed of timothy or Hungarian grass, when being fed to horses or other stock.

RAILROAD CAR WHEELS AND AXLES.—Frederick Sturneyk, Saint Paul, Minn.—This invention has for its object to improve the construction of railroad wheels and axles so as to almost entirely overcome the friction between the wheels and the rails when the cars are passing around a curve in the track.

PLOWS.—Robert Dickie and Hugh K. Johnston, Bunker Hill, Ill.—This invention relates to improvements in plows, and consists in attaching the beam to the plow in a novel manner, for adjusting it horizontally, for varying the breadth of the furrow, and vertically, for varying the depth.

FERRULE FOR PAINT BRUSHES.—Wm. B. Burtnett, New York city.—This invention relates to improvements in the metal ferrules used for confining the but ends of the bristles and the handles together, and it consists in an improved ferrule, made of sheet metal, by stamping up in dies.

COMBINED SHAFTS AND POLE.—John G. Burchfield and S. W. Brock, Niantic, Ill.—This invention relates to improvements in buggies and other light wagons, and consists in an arrangement of shafts so that they may be used as a pole, also, by slightly shifting them, thereby saving the expense of a separate pole and the labor of detaching one and attaching the other.

MEDICAL COMPOUND.—Lewis L. Gebhart, M.D., New Providence, Ind.—This invention has for its object to furnish what has been long sought for, viz: an agent that would not only be beneficial in its local action, when applied to the surface of the body, but, at the same time would be taken up by the general circulation, both of the blood vessels and the nerves.

PAINT BRUSHES.—Wm. B. Burtnett, New York city.—This invention relates to improvements in attaching the bristles and handles together, and consists in securing a handle having a disk on the end, of the size of the upper end of the ferrule,which is larger than the end receiving the bristles, by means of a screw or pin, passing through a conical plug, driven in at the center of the bristles in the same way the handles are in the common construction of brushes, the said disks being also glued or cemented to the ferrules and the ends of the bristles.

TUBING CLAMP.—Wm. H. Downing, Pioneer, Pa.—This invention relates to improvements in tubing clamps or clutches, used for attaching the hoisting chains to oil-well tubing, for hoisting it out of the wells, and consists in the application to a circular hub on the top of a bifurcated block, adapted to receive the tube below the enlarged coupling joint, and for attachment to the hoisting chain of a ring, with an opening, arranged to be set to coincide with the bifurcation, for the reception of the tube, and for turning of the ends to confine the tube therein.

COMBINATION SCRUB BRUSH.—E. K. Wood, De Witt, Iowa.—This invention relates to a new and useful improvement in a scrub brush, with which is combined a water can and rubber dryer or wiper, to the head of which, the brush, water can, and dryer are attached.

SEED PLANTER.—Levi Smith, Chester Center, Mass.—This invention relates to important improvements in machines for planting seeds, more especially designed for planting corn, but applicable to other kind of seeds.

HAND CORN PLANTER.—Hugh Dyer, Fort Scott, Kansas.—This invention has for its object to furnish an improved hand corn planter, simple in construction, and effective, reliable, and uniform in its operation.

MACHINE FOR MAKING TILES, AND ALSO MOLDS FOR THE SAME.—Joseph Christen, New Orleans, La.—This invention relates to a new and useful improvement in a machine for forming tiles for roofs and floors, and for ornamental work for building and other purposes, from clay, cement, or plaster of Paris.

SCALES.—George W. Dickinson, Charleston, Ill.—This invention has for its object to furnish a simple, convenient, accurate, and reliable scale, for weighing light or heavy articles.

ROTARY PUMP.—George W. Heald and L. D. Sisco, Baldwinsville, N. Y.—This invention relates to a new and useful improvement in rotary pumps, whereby they are made more useful and more durable than they have hitherto been, and consists mainly in connecting a lifting or suction pump thereto, for priming or filling the same.

COTTON PICKERS.—D. M. McRae, Webbervillo, Texas.—This invention relates to improvements in machinery for picking cotton from the plants, and consists in a set of saws mounted on a truck, and geared with the driving wheels, to run in the tops of the plants (the lateral parts of which are brought within the range of the saws by gatherers in front) and detach the cotton, and convey it to a brushing roller above, which detaches the cotton from the saws, and delivers it into a receptacle behind.

INDELIBLE WRITING FLUID.—Charles Hebel, Louisville, Ky.—This invention relates to a new and useful improvement in an indelible writing fluid, or ink, designed more especially for use in banks, and for filling up notes, checks, bonds, etc.

SHEET METAL CANS.—Franz Albaum, Greenpoint, N. Y.—This invention relates to a new manner of securing the tops and bottoms in sheet metal cans, with the object of supporting the same firmly, and permitting their rapid application.

COOKING STOVE.—John M. Goodfellow, Troy, N. Y.—This invention consists in providing, in the upper part of the fire-box of a cooking stove, a bridge extending lengthwise of the box, which bridge forms the front side of an air chamber lying horizontally over the oven, and is perforated with a number of holes made for the purpose of letting out jets of heated air from the said chamber directly upon the smoke and gases rising from the fire-box, so that the same may be more thoroughly consumed; the fire-box being also provided with perforated doors so as to let in air in jets for a similar purpose. The invention also consists in the attachment to the stove of a hot water-tank combined with heating chambers; also in providing flue strips for conducting air into the central parts of air chamber over the oven.

COMBINED GANG PLOW AND CULTIVATOR.—Sterling C. Thornton, Macomb, Texas.—This invention consists of sundry improvements in a machine that may serve the purpose either of a gang plow, or, the position of two of the plows having been changed, of a cultivator, said improvements tending to reduce resistance and strain, experienced by the draft animals in drawing the plows through the earth, to their minimum, and to increase the general efficiency of the apparatus.

TIME LOCK.—Lewis A. Haines, Wakefield, Md.—This invention consists in the combination of a lock with a clockwork in such a manner that the lock-bolt may be withdrawn from the keeper at any hour to which the clockwork may be set and not a moment sooner, the lock mechanism being also constructed with peculiar safeguards against burglary.

METALLIC SEAL.—Alexander B. Small, New Orleans, La.—This invention is an improvement on "Mears and Houlton's "Seal for Railroad Freight Cars, etc," patented July 14, 1867, and consisting of a soft metal disk, and a wire that is first passed through staples attached to the door and door-frame of the car, after which, either the ends of the wire are bent, and then inserted in holes extending partly through the soft metal disk, or the branches of the wire are passed entirely through the disk, after which, in either case, the disk is struck with a proper die and compressed upon the wires with force enough to hold them firmly.

BUCKET FOR THE PROPELLING WHEELS OF VESSELS.—A. C. Loud, San Francisco, Cal.—There are certain well-known obstacles which prevent the perfect working of the paddle-wheels and screws, as commonly constructed, of steam vessels. One of these is the lifting of water by the buckets or blades as they emerge, the fluid thus lifted not only retarding the wheel, but also hanging as a dead weight on the vessel and making friction as it is dragged over the surface of the body of water in which the vessel is sailing. Moreover, the striking of the ordinary paddles against the water produces jars, which extend over, and injure the ship, besides annoying the passengers. These obstacles it is the object of this invention to overcome. To this end the inventions consists in buckets or blades constructed of parallel bars, with spaces between them, or of perforated plates, or of bars formed into lattice-work, or in any other manner in which a bucket or blade may be produced which shall present a series of openings through which water may pass, alternating with a series of surfaces against which water may react.

GAGE FOR CUTTING BIAS PIECES.—Samuel T. Taylor, New York city.—This invention consists in the combination of a straight wand with sliding cross-pieces placed at right angles to the wand, in sockets at the ends of the same, and with a cord which connects those extremities of the cross-pieces that are on the same side of the wand, by which arrangement the cord may be set at any desired angle with the wand, on moving the cross-pieces to the requisite extent.

HAY RAKER AND LOADER.—Gilbert G. Park, Xenia, Nebraska.—This invention has for its object to provide an apparatus for raking and loading hay in such manner that the hay will not be disturbed while on the said apparatus by wind or other obstacles.

GIN FOR LINTING COTTON.—George W. Payne, Memphis, Tenn.—This invention relates to a new arrangement of machinery for removing the short lint from cotton seed that has already been ginned, and also for ginning cotton seed as it comes from the field.

COUPLING FOR HEATING CARS BY STEAM.—Samuel A. Appold, Baltimore, Md.—This invention has for its object to connect the steam heating system of pipes of one car with the steam heating system of pipes of another car, by a universally-jointed and expansible coupling placed beneath the bumpers, and so constructed that it may accommodate itself to the curves and irregularities of railways, and to the inequalities in speed which produce variations in the intervals between the cars of a moving train.

BOAT-DETACHING TACKLE BLOCK.—N. M. Ray, Surrey, Maine.—This invention relates to a new and useful improvement in the mode of detaching boats from vessels, and consists in a tackle block provided with a pivot hook and tripping device, by means of which the ends of a boat may be simultaneously detached from the davits by people on board the vessel.

SHOW CASE.—J. A. Holmes, Shopiere, Wis.—This invention relates to improvements in show cases, and consists in the application to them, whether made round, octagonal, or of other form, and revolving or not, of reflecting mirrors arranged in angles of ninety degrees or less for repeating the reflections of the articles to be exhibited which are placed between the reflecting mirrors.

ADJUSTABLE RAILROAD CAR SEATS.—J. I. Pease, Stockbridge, Mass.—This invention has for its object to furnish an improved seat for railroad cars which shall be so constructed that its back and head and foot rests may be swung or inclined into such a position that the passenger may recline or sleep comfortably upon it.

HARNESS MOTION FOR LOOMS.—A. R. Field, Central Falls, R. I.—This invention relates to improvements in harness motion for looms, and consists in a novel arrangement of differential gears for turning two sets of tappet shafts on their own axes while being carried around the shafts of drums on which they are mounted, between which drums the looms are mounted.

HAY AND COTTON PRESS.—Grey Utley, Charlotte, N. C.—This invention has for its object to improve the construction of the improved hay and cotton press patented by the same inventor May 12, 1868, and numbered 77,852, so as to make it more convenient and satisfactory in use, and more effective in operation.

COMBINED HARROW AND ROLLER.—J. M. Blankenbeker, Powers' Station, Ind.—This invention has for its object to furnish an improved harrow which shall be so constructed that the ground may be harrowed and rolled or harrowed, rolled, and cultivated, as may be desired, and which shall, at the same time, be simple in construction, and easily adjusted and operated.

REED ORGAN PIPES.—C. W. Small, Worcester, Mass.—This invention relates to improvements in the construction and arrangement of the pipes used in melodeons, organs, and the like instruments for the purpose of softening the sound and increasing the volume, and it consists of a pipe made of wood or other suitable material, having the reed placed at one side, near one end, and terminating at the other end in a hollow spherical enlargement, with a mouth in one side to emit the sound.

TRACTION ENGINE.—M. P. Hall, Hinsdale, N. Y.—This invention has for its object to furnish a simple and convenient engine to take the place of animal power for various farm purposes, for towing canal boats, and other uses, where the continuous, untiring exertion of power is required, and which will apply the power in the most natural and direct manner.

CHUCKS FOR CUTTING SCREWS ON GAS PIPES OR TUBES.—W. T. Cole, New York city.—This invention relates to a new and useful improvement in chucks for holding gas pipe and other tubing while screw threads are being cut thereon, and for other purposes, the mechanism being such that the pipe or article is released as soon as the thread is cut without stopping the machine or lathe, and also such that the driving power is used for fastening the pipe.

Inventions Patented in England by Americans.

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

PROVISIONAL PROTECTION FOR SIX MONTHS.

2,092.—PRODUCTION OF IRON AND STEEL.—J. E. Sherman, Bucksport, Me. July 25, 1870.

2,094.—WASHING MACHINE.—H. Greaves, Newark, N. J. July 25, 1870.

2,100.—VEGETABLE PARCHMENT OR PARCHMENT PAPER.—C. Campbell, Buffalo, N. Y. July 26, 1870.

2,102.—MANUFACTURE OF RAILWAY WHEELS ALSO IN THE MOLDS AND THE CONVERTING FURNACES TO BE USED IN THE MANUFACTURE OF RAILWAY WHEELS.—J. B. Tarr, Fairhaven, N. Y. July 26, 1870.

2,112.—HEATING WATER FOR STEAM BOILERS.—C. E. Hutson, Commerce, Mo. July 27, 1870.

2,115.—INKING APPARATUS FOR PRINTING PRESSES.—I. L. G. Rice, Cambridge, Mass. July 28, 1870.

2,124.—DEVICE FOR GUIDING COVERED WIRE TO BE SECURED UPON A FABRIC OR SUBSTANCE IN A SEWING MACHINE.—W. T. Cook, New York city. July 29, 1870.

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

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

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.

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.

Official List of Patents.

Issued by the United States Patent Office

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Patent Solicitors, No. 37 Park Row, New York

106,531.—KNITTING MACHINE.—W. H. Abel, Bennington Vt., assignor to himself and J. E. Crane, Lowell, Mass.
106,532.—COAL SIFTER.—Sanford Adams, Boston, Mass.
106,533.—SHEET METAL CAN.—Franz Albaum, Greenpoint, N. Y.
106,534.—MACHINE FOR RULING SLATES.—Franklin Ames, North Bridgwater, Mass.
106,535.—HARVESTER.—V. S. Barber (assignor to Nixon & Co.), Alliance, Ohio.
106,536.—MACHINE FOR SAND-PAPERING MOLDINGS.—Joseph Barker (assignor to himself and Philip Myers), Chicago, Ill.
106,537.—MOTIVE POWER.—Charles Batcheller, Polk county, Iowa.
106,538.—PRUNING SHEARS.—George Bergner, Washington, Mo.
106,539.—COMBINED HARROW AND ROLLER.—J. M. Blanken beker, Powers' Station, Ind.
106,540.—METHOD OF PUTTING FACE-DRESS ON MILLSTONES.—J. S. Braley, J. A. Schmitt, and P. L. Schmitt, Utica, Mo.
106,541.—SCYTHE.—H. C. Brown, Barkhamsted, Conn.
106,542.—COMBINATION OF SHAFTS AND POLE.—J. G. Burchfield and S. W. Brock, Niantic, Ill., assignors to S. W. Brock.
106,543.—LET-OFF MECHANISM FOR LOOMS.—M. C. Burleigh, Somersworth, N. H.
106,544.—PAINT BRUSH.—W. B. Burtnett, New York city.
106,545.—FERRULE FOR PAINT BRUSHES.—W. B. Burtnett, New York city.
106,546.—SEEDING MACHINE.—Alphonso Button, Dunkirk, N. Y.
106,547.—DEVICE FOR PROPELLING CANAL-BOATS.—J. B. Calnan, New Haven, Conn., assignor to himself and V. P. Parkhurst, Templeton, Mass.
106,548.—WHEEL PLOW.—H. C. Carr, Bordentown, N. J.
106,549.—HITCH HOOK.—G. W. Chandler (assignor to himself and Calvin Searle), Mason, N. H.
106,550.—TILE MACHINE.—Joseph Christen, New Orleans La.
106,551.—CHUCK FOR HOLDING PIPES AND TUBES WHILE BEING SCREW-THREADED.—W. T. Cole, New York city.
106,552.—DISH STAND.—W. F. Collier, Worcester, Mass.
106,553.—ROASTING FURNACES FOR ORES.—John Collom Empire City, Colorado Territory. Antedated August 15, 1870.
106,554.—HORSE HAY RAKE.—J. M. Colson, Morrill, Maine.
106,555.—AUTOMATIC BUGGY BRAKE.—L. T. Conant, New Lisbon, Ohio.
106,556.—PLOW.—W. G. Coombs, New Gloucester, Maine.
106,557.—BOTTLE STOPPER.—J. T. Cree, Worcester, Mass.
106,558.—VENTILATING WINDOW FOR RAILROAD CARS.—Samuel Darling, Providence, R. I.
106,559.—PLOW.—Robert Dickie and H. K. Johnston, Bunker Hill, Ill.
106,560.—WEIGHING SCALES.—G. W. Dickinson, Charleston, Ill.
106,561.—MACHINE FOR MANUFACTURING WATCH CASES.—T. B. Dill, Boston, Mass.
106,562.—GRASS-SEED SEPARATOR FOR MANGERS.—D. B. Dixon, Unionville, Mo.
106,563.—TUBING CLAMP.—W. H. Downing, Pioneer, Pa.
106,564.—EARTH CLOSET.—J. A. Drake (assignor to himself and M. E. B. Clark), New Orleans, La.
106,565.—EARTH CLOSET.—J. A. Drake (assignor to himself and M. E. B. Clark), New Orleans, La.
106,566.—EARTH CLOSET.—J. A. Drake (assignor to himself and M. E. B. Clark), New Orleans, La.
106,567.—SPINDLE BOLSTER.—W. F. Draper, Hopedale, Mass.
106,568.—HAND CORN PLANTER.—Hugh Dyer, Fort Scott, Kansas.
106,569.—MANUFACTURE OF INFLAMMABLE GASES FOR FUEL, ETC.—William Elmer, New York city. Antedated August 12, 1870.
106,570.—TRUSS.—T. M. Fell, Glastonbury, Conn.
106,571.—HARNESS-OPERATING MECHANISM FOR LOOMS.—A. R. Field, Central Falls, R. I.
106,572.—COFFEE-POT.—William Funk and G. W. Port, Warrensburg, Mo.
106,573.—MEDICAL COMPOUND.—L. L. Gebhart, Providence Ind.
106,574.—VAPOR BURNER.—Ernest Gillert, St. Louis, Mo.
106,575.—CHURN DASHER.—W. H. H. Gorham and B. H Williams, Greenwich, Ohio.
106,576.—WASHING MACHINE.—Allen Gregg (assignor to himself and Perry Gregg), Springborough, Ohio.
106,577.—TRACTION ENGINE.—M. P. Hall, Hinsdale, N. Y.
106,578.—HEAD BLOCK FOR SAW MILLS.—J. W. Handshy, Tanesville, Ohio.
106,579.—WHEEL CULTIVATOR.—E. D. Hatch, Oconomowoc Wis.
106,580.—GUARD FOR ROOFS.—S. R. Hathorn, Worcester Mass.
106,581.—ROTARY PUMP.—G. W. Heald and L. D. Sisco Baldwinsville, N. Y.
106,582.—INK OR WRITING FLUID.—Charles Hebel, Louisville, Ky.
106,583.—POTATO DIGGER.—Leonard Henderson, Manson, N. C.
106,584.—DRESSING AND TANNING SKINS.—H. A. Hibbard, Augusta, Mich. Antedated August 11, 1870.
106,585.—COATING METAL ARTICLES WITH INDIA-RUBBER.—Constantine Hingher, New Brunswick, N. J.
106,586.—SHOW CASE.—J. A. Holmes, Shopiere, Wis.
106,587.—ATOMIZING TUBE.—T. J. Holmes, Malden, Mass.
106,588.—LIQUID MEASURE AND FUNNEL.—Joseph Hull, Ironton, Mo.
106,589.—MACHINE FOR REPAIRING BOILER FLUES.—John Hughes, Bloomington, Ill.
106,590.—FURNITURE FASTENING.—L. A. Johnson, Candor N. Y.
106,591.—LAST.—Nathaniel Jones, Syracuse, N. Y.
106,592.—SCREW CUTTING MACHINE.—Edward Kaylor, Pittsburgh, Pa.
106,593.—EARTH CLOSET.—Christian Kieffer and J. R. D Seeds, Wilmington, Del.
106,594.—GRAIN DRILL.—S. L. King and Wm. Ogden, Owego N. Y
106,595.—STAY FOR CARRIAGE.—George G. Larkin, Portland, Me.
106,596.—PEN HOLDER.—Robert B. Lawrence, Wheeling, W Va.
106,597.—SIEVE.—R. J. Mann, Dallas City, Ill.

106,598.—LOW-WATER AND HIGH-PRESSURE ALARM.—G. B. Massey (assignor to Massey Low-Water Detector Company), New York city.
106,599.—CHURN.—Riley T. McCormick, Greencastle Junction, Ind.
106,600.—MOTIVE POWER FOR DRIVING STREET CARS.—P. E. McDonnell, Lyons, Ill.
106,601.—COTTON PICKER.—Daniel M. McRae, Webberville, Texas.
106,602.—SEEDING MACHINE.—Daniel E. McSherry, Dayton, Ohio.
106,603.—MACHINE FOR BENDING VOLUTE SPRINGS.—Reuben Miller, Pittsburgh, Pa.
106,604.—HORSE HAY RAKE.—Joseph Mills, Milan, Ind.
106,605.—FRUIT BASKET.—Richard Mitchell, Smyrna, Del.
106,606.—APPARATUS FOR THE MANUFACTURE OF NITRO-GLYCERIN.—George M. Mowbray, North Adams, Mass.
106,607.—APPARATUS FOR THE MANUFA TURE OF NITRO-GLYCERIN, NITRO-BENZOLE, ETC.—Geo. M. Mowbray, North Adams, Mass.
106,608.—CABIN TABLE.—Henry J. Nichols, Searsport, Me.
106,609.—BASE-BURNING STOVE.—Benjamin Nott, Albany, N. Y.
106,610.—AUTOMATIC PASSENGER REGISTER FOR VEHICLES.—Charles Ottinger, Philadelphia, Pa.
106,611.—HAY LOADER.—Gilbert G. Park, Xenia, Nebraska.
106,612.—PIANO.—S. W. Parker, Somerville, Mass.
106,613.—GIN FOR LINTING COTTON.—G. W. Payne, Memphis, Tenn.
106,614.—LUBRICATOR FOR LOOSE WHEELS.—S. E. Peart, McKeesport, Pa.
106,615.—RAILWAY CAR SEAT.—J. I. Pease, Stockbridge, Mass.
106,616.—PRODUCTION OF COLORS FOR DYES, INKS, ETC., FROM ANILINE.—Robert Pinkney, London, England.
106,617.—MATERIAL FOR PASTE FOR BOOK BINDERS AND OTHERS.—Isaac L. Plumer, Chelsea, assignor to J. S. Chase, Harwich, Mass.
106,618.—WAGON AND BUGGY BRACE.—Nicholas Ramseyer, Farmersville, Ill.
106,619.—BOAT-DETACHING APPARATUS.—N. M. Ray, Surrey, Me.
106,620.—PADDLE WHEEL.—James Rees, Pittsburgh, Pa.
106,621.—SPINDLE BOLSTER.—I. P. Richards, Whitinsville, assignor to George Draper & Son, Hopedale, Mass.
106,622.—GRAIN THRASHER, ETC.—Henry Ries, Norwalk, Ohio.
106,623.—WASH BOILER.—Henry R. Robbins, Baltimore, Md.
106,624.—PROCESS OF FORMING SMOOTH TOPS ON GLASS JARS.—Frederick Bohrbacher and Ferdinand Hormann (assignors to S. B. Rowley), Philadelphia, Pa.
106,625.—PRESERVING WOOD.—A. J. Sheldon, Buffalo, N. Y. Antedated August 12, 1870.
106,626.—MANUFACTURE OF FERTILIZERS.—Thomas Sim, (assignor to himself and J. L. Hutchinson) Baltimore, Md.
106,627.—MACHINE FOR DECORTICATING AND DRYING GRAIN.—Evan Skelly, Plaquemine, La.
106,628.—REED ORGAN PIPE.—Chas. W. Small, Worcester, Mass.
106,629.—VAPOR CHANDELIER.—C. E. Smith and H. J. Rice, Columbus, Ohio.
106,630.—VAPOR-BURNING STREET LAMP.—C. E. Smith and H. J. Rice, Columbus, Ohio.
106,631.—SEED PLANTER.—Levi Smith, Chester Center, Mass.
106,632.—PRESERVING MEAT.—Lewis H. Spear, Peekskill, N. Y.
106,633.—FOLDING CHAIR.—Alexander W. Stewart, Boston, Mass.
106,634.—WINDOW FRAME.—Adam W. Stine, Crestline, Ohio.
106,635.—RAILWAY-CAR AXLE.—Frederick Sturneyk, St. Paul, Minn.
106,636.—STACK FOR PUDDLING, BOILING, AND OTHER FURNACES.—William Swindell, Allegheny City, Pa.
106,637.—CURTAIN FIXTURE.—Albert E. Tripp, Springfield, Ohio.
106,638.—HAY AND COTTON PRESS.—Grey Utley, Charlotte, N. C.
106,639.—LIFTING JACK.—A. M. Waters, Cuyahoga Falls, assignor to himself and Henry E. Mariner, Akron, Ohio.
106,640.—FENCE.—Isaiah M. West, Wilmington, Ohio.
106,641.—LOGOTYPE.—Wm. H. Wilkinson, Southwick, Mass. Antedated August 12, 1870.
106,642.—HOISTING MACHINE.—W. C. Williamson (assignor to Williamson Brothers), Philadelphia, Pa.
106,643.—COMBINATION OF OCHERS FOR PAINT.—D. S. Wood, Tiskilwa, Ill.
106,644.—COMBINED SCRUBBING BRUSH, ETC.—E. K. Wood, De Witt, assignor to N. J. Eaton, Montana, Iowa.
106,645.—ADJUSTABLE FRUIT LADDER.—Samuel Wright, Hillsborough, Mo.
106,646.—TABLE.—G. E Young, Providence, R. I., assignor to C. A. Young, and S. W. Young. Antedated August 19, 1870.
106,647.—METHOD OF PREVENTING DECAY IN THE TIMBERS OF BRIDGES, BUILDINGS, ETC.—Augustus Allen, Cass county, Mich.
106,648.—STEAM COUPLING FOR RAILROAD CARS.—S. A. Appold, Baltimore, Md.
106,649.—MANUFACTURE OF SHEARS.—W. B. Barnard and A. J. Barnard, Waterville, Conn.
106,650.—STOVE LEG.—D. L. Bates, Dayton, Ohio.
106,651.—WOODEN PAVEMENT.—G. A. Beidler, Philadelphia, Pa.
106,652.—JACKET FOR HEATING PIPES.—Michael Ber, New York city.
106,653.—DITCHING MACHINE.—Ulric Blickensderfer, Springfield, Pa.
106,654.—BREAD TOASTER.—Alanson Brown, Rochester, N. Y.
106,655.—SAW-MILL DOG.—John S. Brown, Seabrook, N. H.
106,656.—GRAIN FORK.—William W. Bryan, Schaghticoke, N. Y.
106,657.—HEEL BURNISHER.—Moses Burnham, 2d, Wenham, Mass.
106,658.—APPARATUS FOR GAGING OR REGULATING THE FLOW OF WATER OR OTHER FLUIDS.—Edme Augustin Chameroy, Paris, France.
106,659.—EXTENSION STEP LADDER.—H. D. Chance, Llewellyn, Pa.
106,660.—BALING PRESS.—M. D. Cheek, Memphis, Tenn.
106,661.—PIANO.—C. F. Chew, Geoge St., Chalk Farm road, England.
106,662.—STEAM GENERATOR.—Jonathan M. Clark, New York city.
106,663.—FRUIT BOX.—Chas. Colby and H. C. Ward, Benton Harbor, Mich.
106,664.—MUCILAGE HOLDER.—Chas. C. Converse, Brooklyn, N. Y.
106,665.—HAND STAMP.—W. F. Corne, New York city.
106,666.—BED BOTTOM.—A. W. Cramer, Honesdale, Pa.
106,667.—BRONZING MACHINE.—Samuel Crump, Brooklyn, N. Y.
106,668.—NUT LOCK.—David Cumming, Jr., Brooklyn, N. Y. Antedated Aug. 11, 1870.
106,669.—SLIDE VALE FOR STEAM ENGINE.—Francis Curtis, Newburyport, Mass.
106,670.—PORTABLE GATE FENCE.—John W. Curtis, Bath, N. Y.
106,671.—MACHINE FOR CUTTING HOOPS.—W. H. Davis (assignor to himself and Joseph Harlan), Lexington, Ind.
106,672.—STOP-MOTION FOR BRAIDING MACHINES.—E. W. Dean, Norwich, Conn.
106,673.—PUM-ROD CONNECTION FOR DEEP WELLS.—H. De Zavala, New York city. Antedated Aug. 11, 1870.
106,674.—REVOLVING ROAD SCRAPER.—E. M. Doty, J. L. Little, and P. A. Schmidler (assignors to E. M. Doty), Springfield, Ohio. Antedated Aug. 13, 1870.
106,675.—SPINNING MACHINE.—William Duffner, Petersburg, Ind.
106,676.—MACHINE FOR VARNISHING AND DRESSING LOOM HARNESS.—E. J. Ellis, Lewiston, Me.
106,677.—HARROW.—G. M. Ellis, Huntertown, Ind.
106,678.—HUB FOR CARRIAGE WHEELS.—J. M. Emmerich, New Haven, Conn.
106,679.—CARPET DUSTER.—Thomas Ferry, Wilmington, Del.
106,680.—HAIR BRUSH.—S. M. Firey, Clear Spring, Md.
106,681.—UMBRELLA.—Samuel Fox, Stockbridge Works, Deepcar, near Sheffield, England. Patented in England, September 21, 1868.
106,682.—BALLOT BOX.—Gilbert Adolphe Frebault, Paris, France.
106,683.—STEAM PUMP.—Alexander Friedmann, Vienna, Austria.
106,684.—COMBINED MOP HEAD AND WRINGER.—Wm. Gage, Buffalo, N. Y.
106,685.—WOOD-MOLDING MACHINE.—A. S. Gear, New Haven, Conn.
106,686.—APPARATUS FOR COOLING BEER.—Wm. Gee, New York city.
106,687.—THILL COUPLING.—W. S. Geer, Marshall, Mich.
106,688.—COOKING STOVE.—J. M. Goodfellow, Troy, N. Y.
106,689.—VAPOR BURNER.—Benjamin D. Greene, Sturgis, Mich.
106,690.—CONSTRUCTION OF DITCHES.—Tobias K. Grube, Napoleon, Ohio.
106,691.—TIME LOCK.—L. A. Haines, Wakefield, Md.
106,692.—PARLOR ORGAN.—E. Hamlin, Winchester, Mass., assignor to Mason & Hamlin Organ Co.
106,693.—CORN PLOW.—Henry Harrier, Indianapolis, Ind.
106,694.—MACHINE FOR CUTTING BLIND SLATS.—J. W. Helder (assignor to himself and Luther Trescott), Shannon, Ill.
106,695.—CHURN.—F. M. Hindman and Nicholas Hiatt, Sidney, Iowa.
106,696.—BLOTTING PAD.—G. C. Hinman, Boston, assignor to L. L. Tower, Somerville, Mass.
106,697.—FLOUR BOLT.—J. H. Jones, Yellow Springs, Iowa. Antedated Aug. 12, 1870.
106,698.—BALE TIE.—W. A. Jordan, New Orleans, La., assignor to E. P. Jones.
106,699.—MANUFACTURE OF GAS FOR ILLUMINATION, ETC.—Joshua Kidd, New York city. Patented in England January 5, 1864.
106,700.—MACHINE FOR TREATING RAMIE AND OTHER TEXTILE PLANTS.—Emile Lefranc and Joseph Nagoua, New Orleans, La.
106,701.—ADDING MACHINE.—F. T. Leilich (assignor to himself and Michael Leilich), Frederick, Md.
106,702.—POTATO PLOW.—Augustus Leonard, Newell's Run, Ohio.
106,703.—BALING PRESS.—Conrad Locher, Oroville, Cal.
106,704.—BUCKET FOR PADDLE WHEELS.—A. C. Loud (assignor to himself and W. J. Miller), San Francisco, Cal.
106,705.—PRUNING SHEARS.—Enoch J. Marsters, Shaw's Flat, Cal.
106,706.—FRUIT CORER.—Enoch J. Marsters, Shaw's Flat, Cal.
106,707.—STRAW CUTTER.—Albert P. Massey, Cleveland, Ohio.
106,708.—HOT-AIR FURNACE.—John McCoy, Burlington, N. J., assignor to himself and Carbon Stove Co.
106,709.—DRAIN TUBE.—James McMillan, Perinton, N. Y.
106,710.—MANUFACTURE OF PAPER PULP FROM WOOD.—H. B. Meech, Fort Edward, N. Y.
106,711.—REDUCING AND BLEACHING PAPER STOCK.—H. B. Meech, Fort Edward, N. Y.
106,712.—LUBRICATOR.—James Meehan, Covington, Ky.
106,713.—FORM OF INGOTS FOR CORRUGATED METAL BEAMS.—Richard Montgomery, New York city.
106,714.—FIRECRACKER HOLDER.—Charles Mott, Bergen City, N. J.
106,715.—WATER-POWER WHEEL.—John Nipp, Jr., Raleigh, Ind.
106,716.—HAND STAMP.—M. P. Norton (assignor to Helen M. Ingalls), Troy, N. Y.
106,717.—TREATING BITUMINOUS SUBSTANCES FOR PAVEMENTS, ETC.—Jas. O'Friel, Brooklyn, N. Y.
106,718.—SOLAR TIME INSTRUMENT.—F. M. Pannetrat, Paris, France.
106,719.—FRUIT BASKET.—S. D. Payne, Kasota, Minn.
106,720.—MACHINE FOR BENDING WIRE SCREW EYES.—N. N. Perry, Chester, Conn.
106,721.—MOLE-DITCHING MACHINE.—Alfred Peterson, Stockwell, Ind.
106,722.—ICE MACHINE.—Chas. Plagge (assignor to himself and T. C. Glazier), New York city.
106,723.—CAN OPENER.—A. C. Platt, Sandusky, Ohio.
106,724.—MACHINE FOR VARNISHING AND LABELING FRUIT CANS AND OTHER CYLINDRICAL PACKAGES.—A. C. Platt, Sandusky, Ohio.
106,725.—SKATE.—A. C. Platt, Sandusky, Ohio.
106,726.—BED BOTTOM.—George Richardson, Milwaukee, Wis.
106,727.—PUMPING ENGINE.—Louis C. Rodier, Springfield, Mass.
106,728.—CULTIVATOR.—John Root, Hartland, N. Y.
106,729.—CIRCULAR SAW MILL.—T. H. Russell, Northfield, Vt. Antedated August 17, 1870.
106,730.—BINDING ATTACHMENT FOR SEWING MACHINES.—J. W. Sawyer, Boston, Mass., assignor to F. Draper & Co., Cambridge, Mass.
106,731.—FIFTH-WHEEL FOR CARRIAGES.—Henry Sayler, Saint Paris, Ohio.
106,732.—BREECHING ATTACHMENT FOR HORSES.—Wm. F. Schatz, Columbus, Ohio.
106,733.—CULTIVATOR.—N. S. Shields, Rockford, Ill.
106,734.—METALLIC SEAL.—Alex. B. Small, New Orleans, La.
106,735.—POCKET SUN DIAL.—D. L. Smith, Waterbury, Conn.
106,736.—VAPOR BURNER.—Willard H. Smith, New York city.
106,737.—MEANS FOR ADJUSTING CAR WHEELS TO DIFFERENT GAGES.—W. B. Snow, New York city.
106,738.—SUSPENSION RING.—D. M. Somers, Brooklyn, N.Y., assignor to Levi L. Tower, Somerville, Mass.
106,739.—RAILWAY CAR SEAT.—W. Horace Soper, Baltimore, Md.
106,740.—STOCK OR BLANK FOR BRACELETS.—I. B. Staples, Attleborough, Mass.
106,741.—GAGE FOR CUTTING BIAS PIECES OF CLOTH.—S. T. Taylor, New York city.
106,742.—HARROW.—Cornelius Thayer and L. L. Thomas, Otego, N. Y.
106,743.—COMBINED GANG PLOW AND CULTIVATOR.—S. C. Thornton, Macomb, Texas.
106,744.—HEAD-BLOCK OF SAW MILLS.—Wm. B. Trunick, (assignor to N. B. Connel), Louisville, Ky.
106,745.—CULINARY APPARATUS.—John Van, Cincinnati, Ohio.
106,746.—HOT AIR FURNACE.—John Van, Cincinnati, Ohio.
106,747.—CALK FOR BOOT AND SHOE.—J. L. Wager and A. L. Scudder, Sanford, N. Y.
106,748.—SKATE.—E. P. Waggoner, Syracuse, N. Y.
106,749.—WALLS FOR BUILDINGS.—James Weathers (assignor to himself and V. P. Harris), Greensburg, Ind.
106,750.—COAL STOVE.—J. R. Webber, Morris, Ill.
106,751.—SEED PLANTER AND FERTILIZER.—D. P. Webster, Boston, Mass.
106,752.—SHUTTLE FOR SEWING MACHINE.—W. W. Wells, Webster, Iowa.
106,753.—VAPOR BURNER.—Joseph White (assignor to himself and J. B. Wickersham), Philadelphia, Pa.
106,754.—BIT STOCKS.—Charles P. Whitman, Charlemont, Mass.
106,755.—SHAFT COUPLING.—S. H. Whitmore (assignor to C. C. Burroughs and James Milliken), Decatur, Ill.
106,756.—SHAFT COUPLING.—Seth H. Whitemore (assignor to C. C. Burroughs and J. Milliken), Decatur, Ill.
106,757.—WEATHER STRIP.—Henry W. Wicker, Norwich, Conn.
106,758.—COMBINED FORK AND BAND CUTTER.—M. Wenger, Upper Leacock Post Office, Pa.
106,759.—DEVICE FOR REMOVING LIME FROM HARD WATER.—Kasson Frazer, Syracuse, N. Y.

REISSUES.

4,103.—SPRING MATTRESS.—E. L. Bushnell, Poughkeepsie, N. Y.—Patent No. 95,994, dated Oct. 19, 1869.
4,104.—BUGGY TOP.—A. M. Cory, New Providence, N. J.—Patent No. 97,479, dated December 7, 1869; antedated November 30, 1869.
4,105.—CHERRY STONER.—George Geer, T. G. Hadley, and William Hamilton, Galesburg, Ill., assignees of George Geer.—Patent No. 63,715, dated April 9, 1867.
4,106.—STONE PAVEMENT.—Charles Guidet, New York city.—Patent No. 85,814, dated Jan. 12, 1869.
4,107.—APPARATUS FOR CRUTCHING SOAP.—Geo. M. Leslie, Northumberland, Pa., assignor to himself and Jesse Oakley, New York city.—Patent No. 44,142, dated Sept. 6, 1864.
4,108.—BRICK MACHINE.—The United States Brick Machine Co., Chicago, Ill., assignees of B. M. Gard and E. R. Gard.—Patent No. 100,130, dated Feb. 22, 1870.

DESIGNS.

4,298.—LAMP STAND.—J. S. Atterbury and T. B. Atterbury, Pittsburgh, Pa.
4,299.—CLOCK FRONT.—John H. Bellamy, Charlestown, Mass.
4,300 and 4,301.—"PERSIAN CLOAK."—T. Dolan, Philadelphia, Pa. Two Patents.
4,302.—JOINING WOOD.—C. B. Knapp, Waterloo, Wis.
4,303.—HAIR PIN.—G. W. Manson (assignor to C. M. Vandervoort and W. F. Fluhrer), New York city.
4,304.—ASH PAIL.—John Merry, New York city.

EXTENSIONS.

PEGGING JACKS.—Alfred Bailey, of Amesbury, Mass.—Letters Patent No. 15,406, dated July 29, 1856.
ROTARY KNITTING MACHINE.—S. W. Park, of Albany, N.Y., and E. S. Ells, of Fremont, N. Y.—Letters Patent No. 15,492, dated Aug. 5, 1856.
SEWING MACHINE.—Extended by an Act of Congress.—John Bachelder, of Boston, Mass.—Letters Patent No. 6,439, dated May 8, 1849; reissue No. 617, dated November 2, 1858.

APPLICATIONS FOR THE EXTENSION OF PATENTS.

MACHINE FOR PARING APPLES, POTATOES, ETC.—Elizabeth V. Pratt, North Beverly, Mass., has petitioned for the extension of the above patent. Day of hearing Oct. 26, 1870.

BURGLAR-PROOF SAFES.—William H. Butler and Sarah A. Holmes, New York city, have petitioned for an extension of the above patent. Day of hearing Nov. 2, 1870.

PLATFORM SCALES.—Francis M. Strong and Thomas Ross, Vergennes, Vt., have petitioned for an extension of the above patent. Day of hearing Nov. 9, 1870.

CURRYCOMB.—Elliott P. Gleason, New York city, and Alvah Crosman North Providence, R. I., have petitioned for an extension of the above patent. Day of hearing Nov. 9, 1870.

HARVESTING MACHINE.—William N. Whiteley, Springfield, Ohio, has applied for an extension of the above patent. Day of hearing Nov. 9, 1870.

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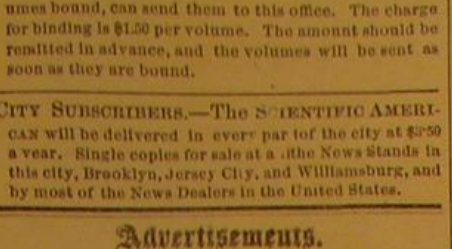

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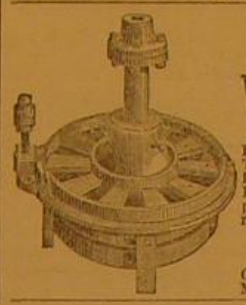

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Vol. XXIII.—No. 11. [NEW SERIES.] NEW YORK, SEPTEMBER 10, 1870. $3 per Annum, [IN ADVANCE.]

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.

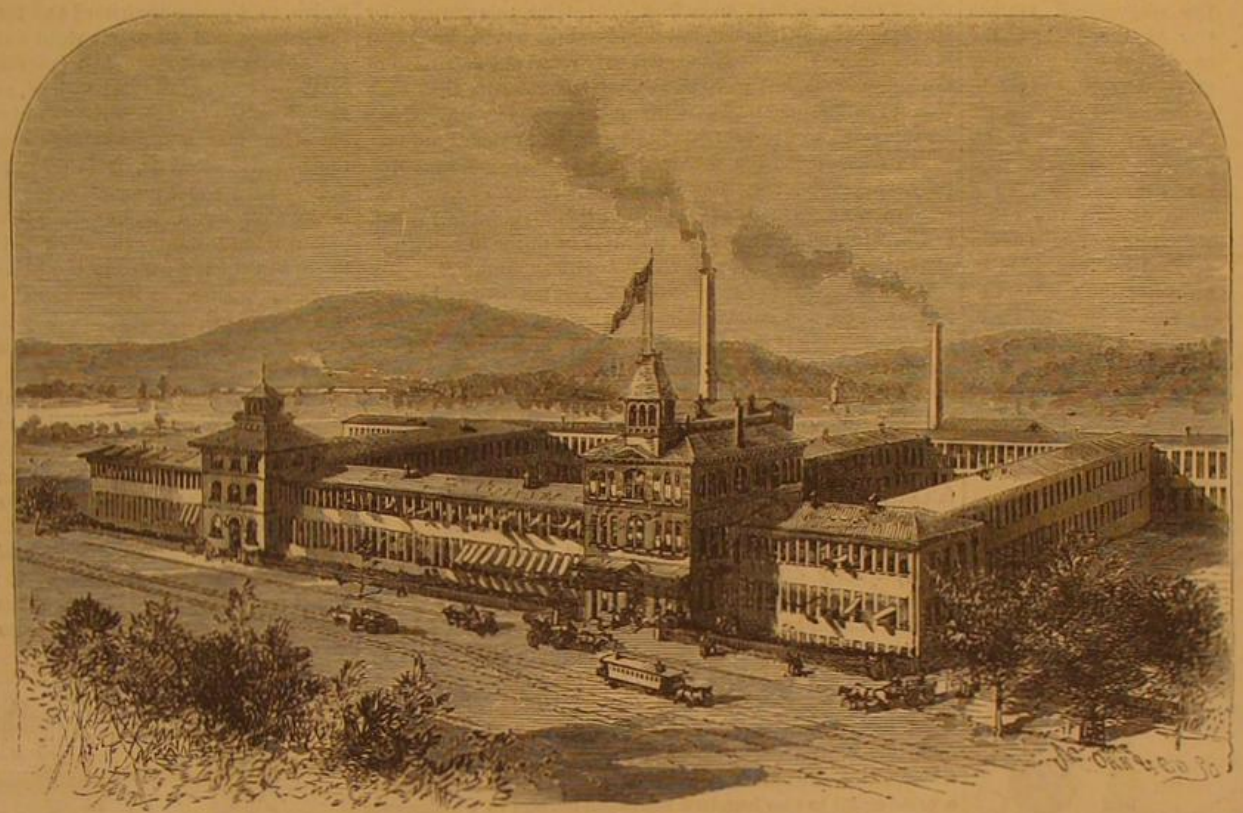
The accurate time-keeper was the indispensable predecessor of the locomotive and travel by railway. That it first made possible those rapid movements of multitudes over vast tracts of land and sea, by which people in these latter days have widened their experiences and attained a kind of terrestrial 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 cries 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.

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 time-keeper 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 train 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

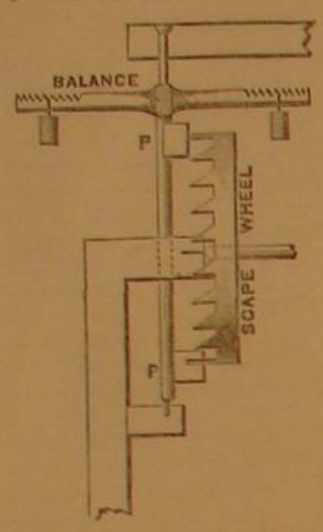


VIEW OF THE WALTHAM FACTORY AT WALTHAM, MASS.

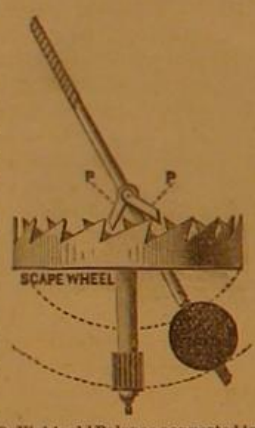
ONE OF THE WORKING ROOMS—INTEGRATION OF THE WATCH INDUSTRY.

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 its 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.



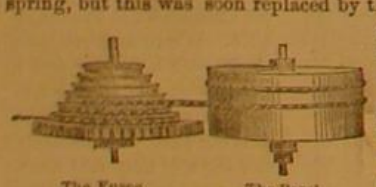
Balance and Escapement of the First Clock. P P, the Pallets.



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.

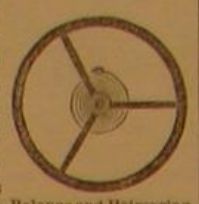
The gearing was first impelled, it is said, by a straight spring, but this was soon replaced by the coiled mainspring, a band of fine steel rolled up in a drum, or barrel, and which produced, in unrolling, the effect of the weight. In the case of the clock, the maintaining force, or descending weight, 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.

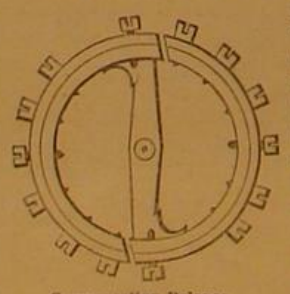
The Watch Balance.

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.

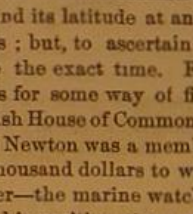

Balance and Hairspring

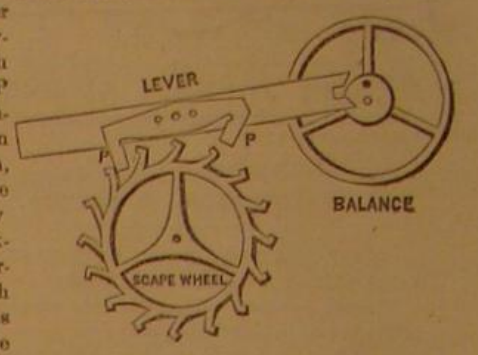
The next important step of improvement in watch construction was made one hundred and seventy years ago, and consisted in the application of jewels for the bearings of pivots. Precious stones were first drilled for this purpose by Nicolas Facio, a Genevan, but who brought out his invention in England. 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.

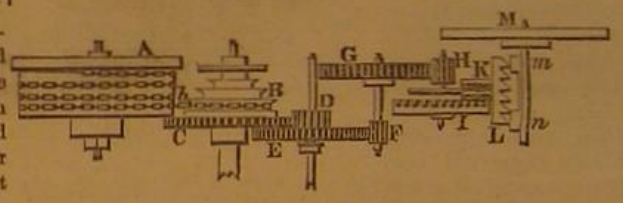


The Patent Lever, Detached Lever, or Detached Escapement.—P P, the Pallets.

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.

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


Movement of the Common Vertical Watch.

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.

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 changes 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-devel-

oped 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

Gilding the Wheels.

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.

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

Enameling the Dials.

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

Fitting the Dials.

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

Gold and Silver Working.

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 $\frac{1}{2500}$ of an inch; the second to the $\frac{1}{12500}$ of an inch; and the third to the $\frac{1}{125000}$ 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.

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.

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.

Minute watch-screws.

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

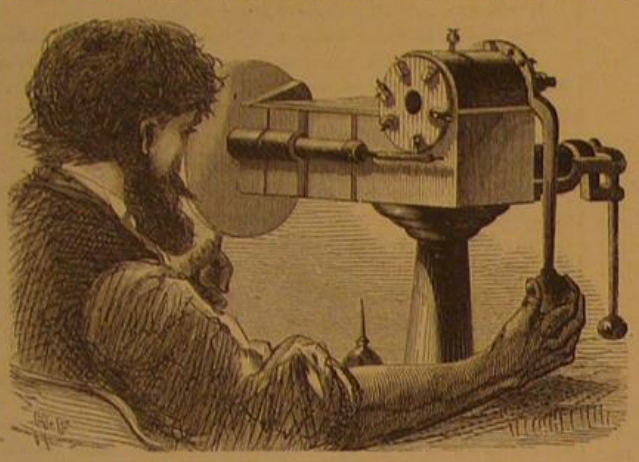
Scape-wheel magnified.

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



Escapement-wheel Machine.

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.

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 *balcanky*. 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 *balcanky* 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 *balcanky* 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.*

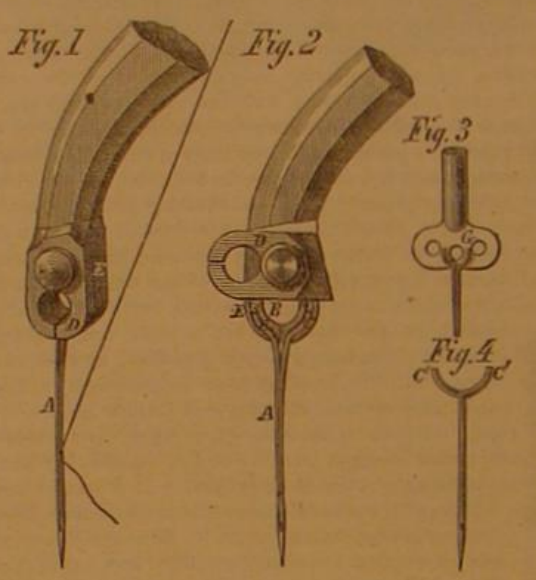
Brave Act of an Engineer.

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 of 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 submarine 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.

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.

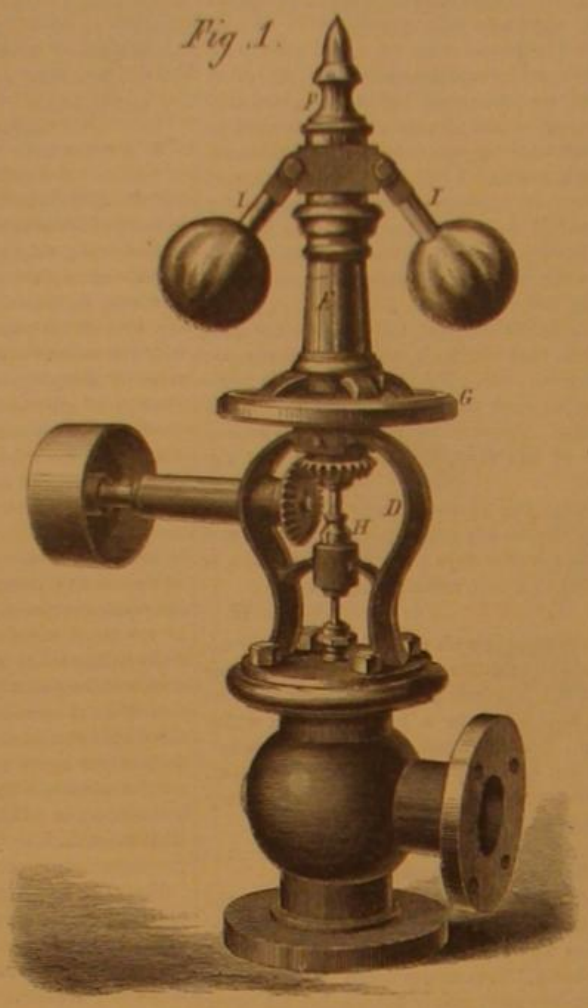
The spindle of the revolving head connects to the sleeve by a collar, and passing down through the upper part of the frame, connects with the miter gears by a feather and groove, so that it may be readily raised and lowered for regulating the valve without disturbing the driving gear.

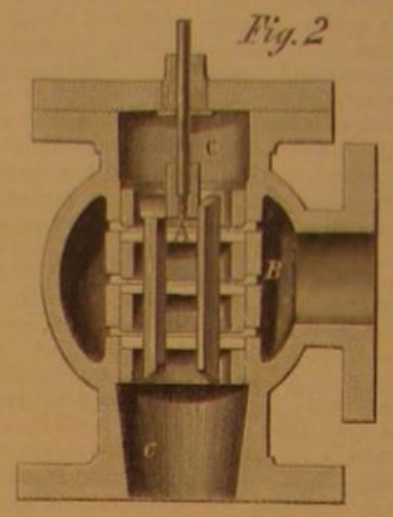
The head, F, is fitted with a novel movement, as shown in Fig. 3, by which graduation is effected. The ball arms, I, are connected to the head by pins in the usual manner. These arms have cam-shaped ends, having teeth cut in their periphery, which gear into the wedge block fastened to the valve rod. 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.

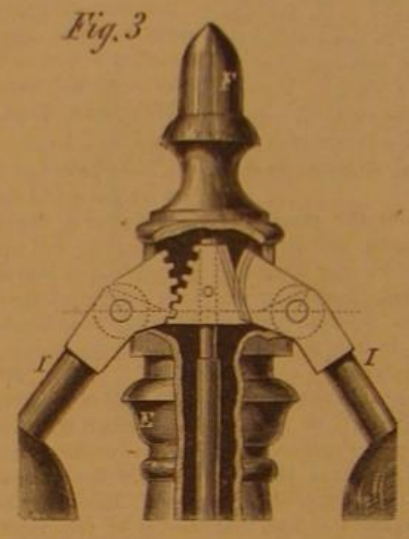
The operation of this governor is very simple, and it has full control of the engine at all times, the position of the valve is such that when the compensating wheel is at its lowest point (the balls being down), the valve presents a half-open port, thus admitting steam sufficient to start the engine, 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.







CONDE'S IMPROVED STEAM GOVERNOR.

Improved Window-Blinds.

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.

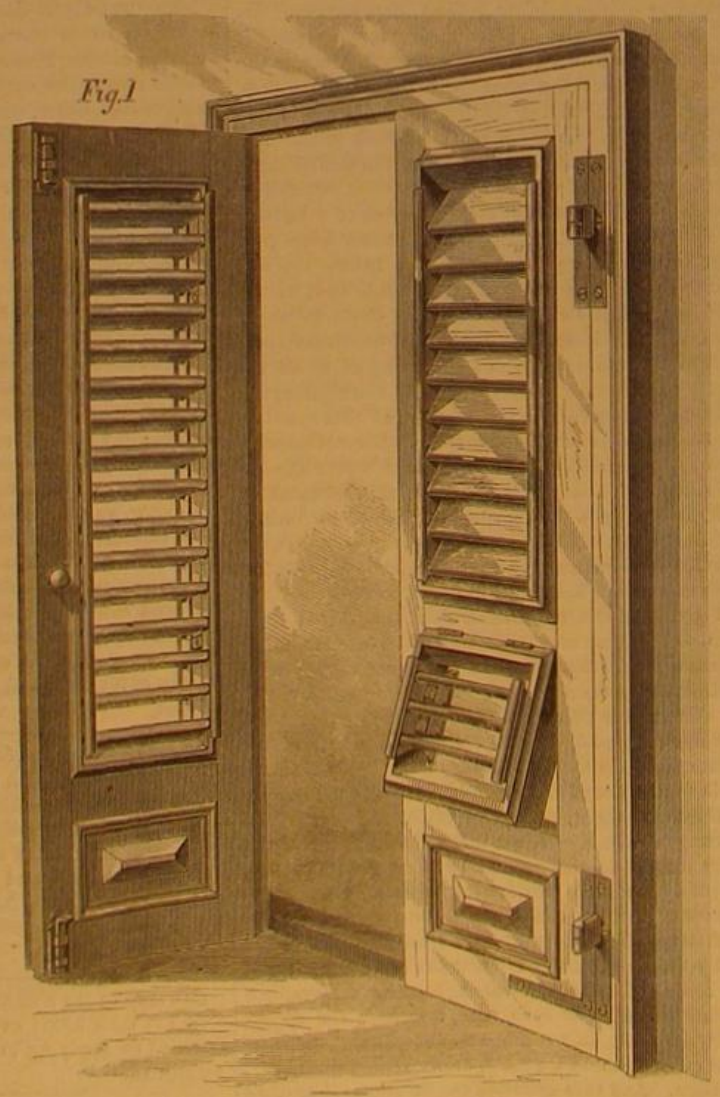
The method of pivoting the slats illustrated herewith does away with all this inconvenience, and, at the same time, gives a more finished and elegant appearance to the blind. It also makes tighter joints at the ends of the slats to exclude wind and rain.

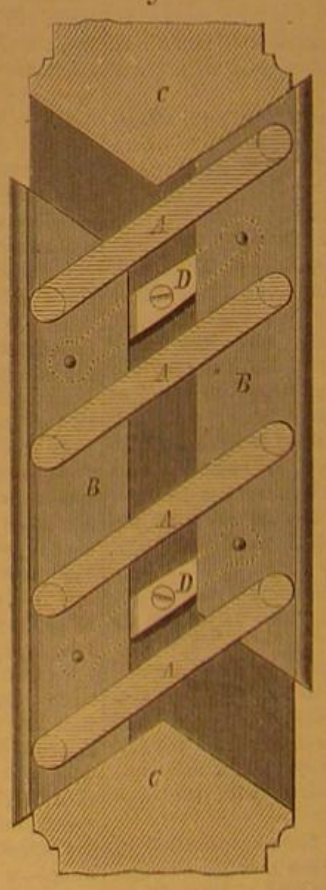
The method of pivoting the slats is shown in Fig. 2, in which A represents the slats, each having two tenons formed on each end. These tenons play in holes formed in two vertical bars, B, placed on both sides of the series of slats. These bars are formed with beads or moldings on their outer edges, the 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.





DONATO'S IMPROVED WINDOW-BLIND.

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.

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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.

*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.

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 with 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-

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.

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 curcela*), 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 pigeons.

"*Cicada*, 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.

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.

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. Heppin; 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.

2,171.—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. 3, 1870.

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

2,175.—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.

2,205.—BALANCE ELEVATORS.—C. B. Sawyer, Fitchburg, and J. W. Labaree and F. 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.

Wanted—The address of manufacturers of Music Boxes. Address J. S. Brown, Colerain P. O., Ohio.

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.—If 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. K. 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., ¾ 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, 332 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-ton 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.

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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.

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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 you 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 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 felloes 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.

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FOR THE WEEK ENDING August 30, 1870.

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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 Follansbee (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, Mo.

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 Blagher, 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. 18, 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, Sanders, Pa.
106,838.—MANUFACTURE OF PLOWSHARES.—John Lane (assignor to himself, C. H. Bagood, 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, 1869.
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 Apple), 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, Riggiesville, 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 25, 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. Dallón, 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, Nauzatuck, 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. Fans, 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. 59,130, 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. 3,239, 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. 3,238, dated February 2 1869.
4,112.—PARING KNIFE.—J. J. LeBeau, Cincinnati, Ohio.—Patent No. 56,225, dated July 10, 1866.
4,113.—ANIMAL TRAP.—J. A. Lee, Chattanooga, Tenn., assignor, through mesne assignments, to R. D. Mann.—Patent No. 85,642, 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.—Robert 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 Tasite 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. 6,459, 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. 15,561, dated August 5, 1856; reissue No. 3,393, 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, 1869.
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. 15,619, dated August 26, 1856.

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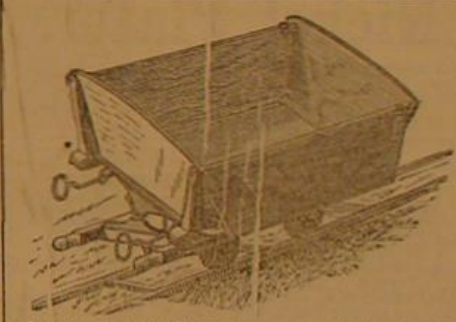

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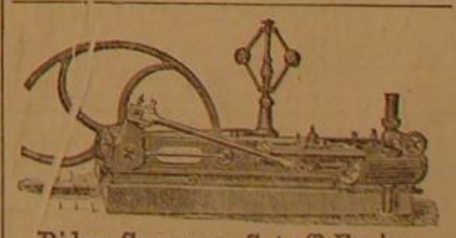

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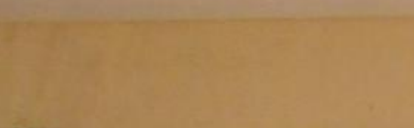

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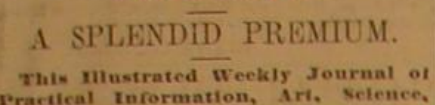

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SCIENTIFIC AMERICAN

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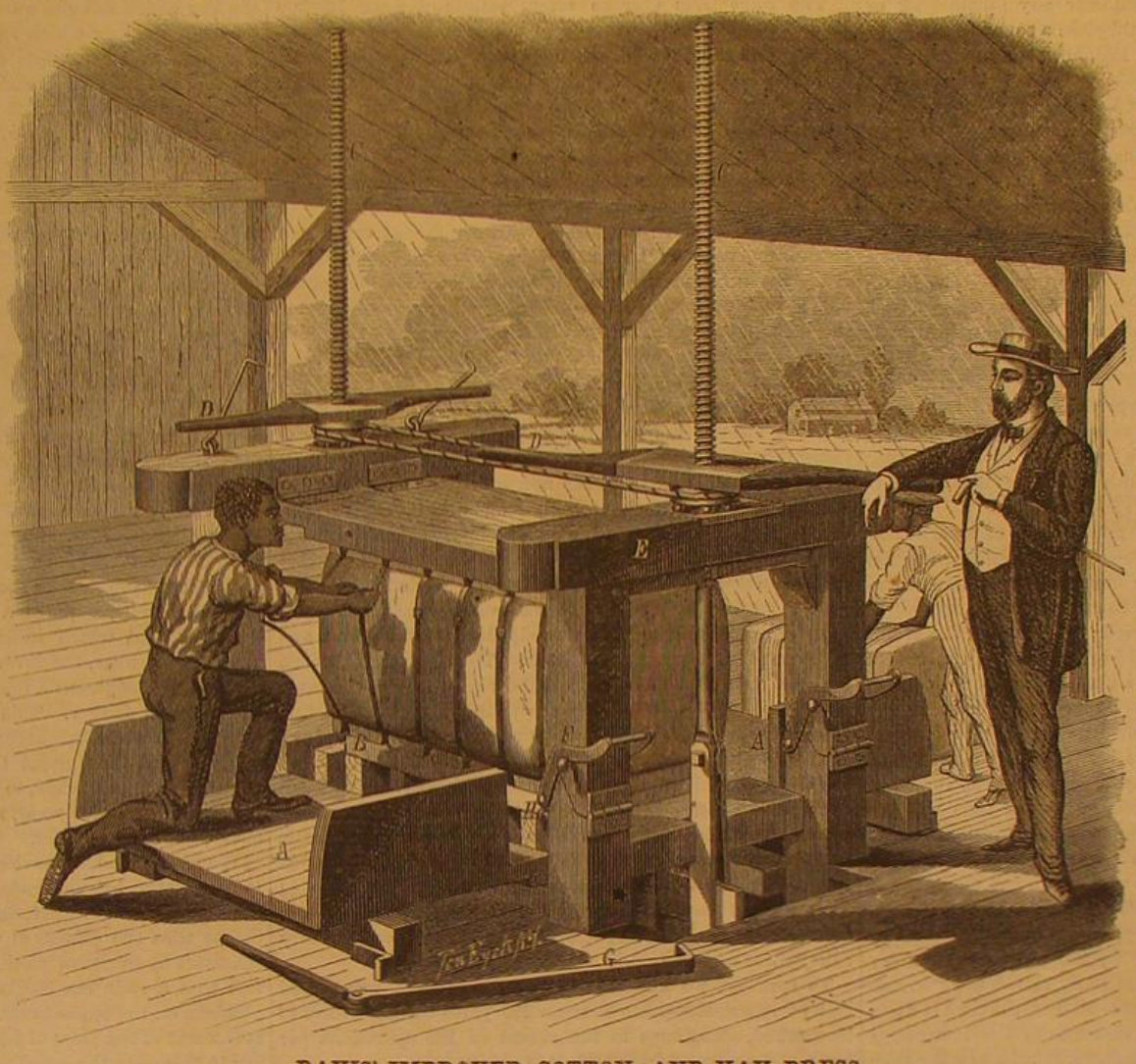
Improved Cotton and Hay Press.

A simple, economical, durable, and, at the same time, strictly practical cotton and hay press, has long been a desideratum in the Southern States. Though presses for baling hay have been constructed that answer that purpose admirably, when applied to cotton, they have not met the wants of cotton packers, as is evidenced by the fact that still the old-style wooden press is used to a greater extent than perhaps any other for packing cotton. Some of these presses have had their good points, which led planters to believe that at last *the* press they had been looking for was devised, but on trial they have manifested defects which offset their merits to such an extent, that they failed to fulfill their promise.

But in these times of progress, when wood has given way to iron and iron is yielding precedence to steel, and manual labor and horse-power are being superseded by the steam engine, it is scarcely to be expected that the old wood screw press, cumbersome and inconvenient, will be much longer tolerated.

One reason why the presses heretofore offered to the cotton planter have failed, is because many of them have been constructed with a view to simply compress readily and strongly without due regard to other necessary requirements. These presses have to be placed outside the ginning room. The cotton is carried to them in baskets from the gin, the baskets containing some two hundred pounds of cotton, picked up by hand, and stamped into them. When the press is reached this cotton has to be pulled out of the baskets, put into the press again, and again stamped with the feet. When the press stands wholly above the floor, as is the case with presses in which the pressure is applied to the upper platen, its weight has to be raised to the top of the press, a severe and exacting labor.



DAVIS' IMPROVED COTTON AND HAY PRESS.

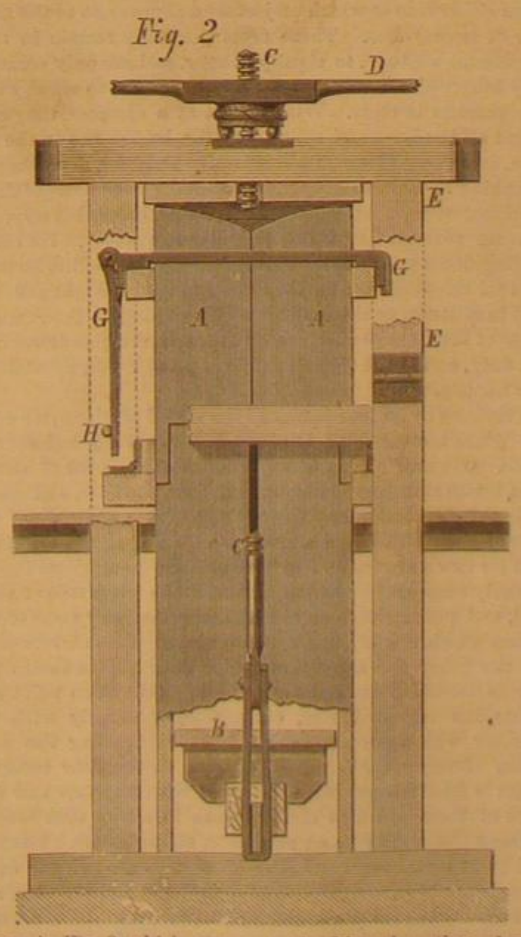
The press herewith illustrated is invented by an experienced cotton planter and ginner, who, perfectly familiar with the requirements of the case, has reversed the plan of applying pressure to the upper platen, applying it instead to the lower one, whereby he is enabled to sink his press through the floor of the cotton or lint room, thus avoiding exposure to weather and the labor of lifting the cotton. The latter saving is so great that the inventor has publicly challenged all presses to compete with his in packing, claiming that it will do materially more, in a given time and with the same number of hands, than any other press yet invented.

The press is a model of simplicity, is cheap and durable. As the engraving shows, it is expressly designed to be used inside of, or adjacent to the lint-room, and may be worked with equal facility in either the second or ground floor, thereby saving a portion of the labor of partially compressing the cotton in baskets or sacks preparatory to carrying it out and up to the mouth of the box of the press, as in all cases where presses are worked outside the lint-room and in which the bale is formed at the bottom of the box, and also saving the whole of the time and labor expended in carrying out the lint, besides preventing damage from wind, rain-storms, dropping upon the ground, etc. These advantages will be seen and duly appreciated by practical cotton packers.

Upon reference to Fig. 1, it will be seen that the upper part of the press box is formed of two hinged segments, A, which are thrown back into the position shown while sewing and banding the bale. At this time the lower platen, B, is raised and held slightly above the level of the floor by the screws, C. These screws are worked by nuts and levers, D, both nuts and screws being of iron and made very strong and durable.

When it is desired to release the bale, the upper part, E, of one side of the press frame, which is also hinged, and which, when in the position shown, engages with the top of the upper platen, is thrown outward, releasing the upper platen, so that it is lifted back like the lid of a box, and held by hooks provided for that purpose. The part, E, of the press frame is held in place by strong turn-buckles, F, while the cotton is being compressed.

The hinges, however, are not submitted to any material strain by the action of the screws as the hinged sections of the upper part of the box are held in such a manner as to transfer the outward pressure to be transferred to other parts especially designed to receive and sustain it. These parts are



shown in Fig. 2, which represents the hinged sections closed and ready to receive the pressure from the screws through the medium of the inclosed lint. In this position of the press, the hinged sections are held together by strong iron clamping bars, G, having pivoted levers which, when the sections are clamped, are held by stout pins, H. The ends of the bars opposite the levers are bent down at right angles, and hook over angular iron plates attached to stout pieces of timber which extend entirely across and are bolted to the hinged sections of the box. These clamping bars, together with the timbers described, serve to bind the hinged sections on all sides, and they receive the pressure when the press is in operation. They can be adjusted in a moment's time, but four or five movements being necessary to close the press and clamp it ready to receive the cotton. The upper and hinged platen or lid is left open while the cotton is put in the press, which does not take materially longer than to pack it in the baskets or sacks heretofore used to carry the cotton to the press. The top is then closed and fastened, and the screws are then run up by means of the nuts and levers, D, carrying up with them the lower platen, B, and compressing the bale. The clamping bars, G, being then taken off, the bale is stitched and banded.

A detachable cord belt works in grooves turned in the nuts, by which means the screws are rapidly run down when the bale is taken out.

Altogether we regard this as one of the most simple and practical cotton presses we have seen, and as such well worthy the attention of cotton packers.

Patented, through the Scientific American Patent Agency, September 29, 1869 (and other improvements are pending before the Patent Office), by Joseph K. Davis, of Monticello, South Carolina, who may be addressed for further information or for territorial rights.

BELLS AND BELL METAL.

Every one has read about the enormous bells made in Russia and China; and nearly every one has some acquaintance with the troubles which at first beset the two bells cast successively for the Houses of Parliament at Westminster. But there are many interesting facts connected with the tones or sounds of bells which are not so familiar. Those sounds had formerly much more importance attached to them than they have now. A firm belief existed that the sound of church bells would drive away thunder and lightning, and repel demons and evil spirits; in fact, these were parts of the same superstition, seeing that the production of thunder and lightning was attributed to the malevolent agency of fiends. Times were, when bells were also rung during eclipses, to drive away the malevolent fiend who was supposed to hide the beautiful face of the sun or moon.

It was a very frequent custom to include a rhymed enumeration of these and other uses of church bells in the inscriptions they bore. One English form, frequently adopted, was this:

> To call the folks to church in time—I chime
> When mirth and joy are on the wing—I ring.
> When from the body parts the soul—I toll.

The sound of a bell depends, of course, on many different circumstances or conditions. One of these is the metal of which the bell is composed. The mixed metals or alloys illustrate in an instructive way the differences of quality which result from differences in the proportion of ingredients. Copper and tin produce the metal bronze; in other proportions they yield speculum metal, for making the brilliantly white reflectors of telescopes; while in other proportions, again, they furnish bell metal. The Chinese in their gongs and the Europeans in their bells have seen reason to employ pretty nearly the same kind of metal. There is always much more copper than tin; but every bell founder has his favorite recipe in this matter. Some adopt simply four of copper to one of tin; some thirty-two copper to nine of tin. Big Ben has about twenty-two copper to seven of tin. Mr. Layard found at Nineveh bells which had as much as ten parts copper to one of tin. It is, therefore, evident that no very great amount of exactness is necessary in this matter. It is consid-

ered, in a general way, that an extra dose of tin improves the sound, but renders the alloy more brittle; the founder, therefore, establishes a balance of advantages according to his judgment and experience. When a large bell is annealed very slowly, the sonorous quality of the mass is improved.

Bell metal, though the most general, is not the only material for bells. Sometimes a little lead, arsenic, or zinc, is added to the copper and tin. It used to be a favorite idea that silver, thrown into the melting furnace, improves the tone of a bell. As for other metals besides copper, tin, and silver, it is known that steel and iron are occasionally used for church bells. Such bells have been cast at Westphalia, at Sheffield, and at Dundyvan, near Glasgow. Steel bells are lighter and cheaper than those of bell metal, and yield a rich and brilliant tone; but the sound is said to be unable to penetrate to a great distance. Cast iron with the addition of a little tin, has been tried; but the alloy was far too brittle. Glass bells, and wooden bells, are also talked about; but we do not see how the former could bear any hammering or clappering, nor how the latter could yield a sound worth hearing. One of the missionaries to Fiji, however, has described a bell or sounding instrument made from the hollowed trunk of a tree, like a trough, and placed on a coil of rope or some other elastic mass on the ground; when struck at one end with a mallet, it gives out a stifled roar which we are told could be heard twelve miles off.

The sound of a bell is further dependent on size, shape and proportion. The familiar "bell-shape" is not a mere random guess or fancy. It has been found by experiment, after comparing sounding bodies shaped like springs, spirals, hemispheres, tuning forks gongs, cylinders, flat plates, etc., that a bell of the ordinary shape, and of the same weight, will give out its sound to a greater distance than any of them; albeit, some of the others yield rich and deep tones. In describing the several parts and proportions of a bell, the founders speak of it almost as a living being, with its head, mouth, waist, and haunch. Some bells are made with very long waists, almost cylindrical; but this is not a general characteristic.

As to the actual tone, pitch, or musical note of a particular bell, it does not depend on any one of the dimensions singly, but on the relation between the diameter, hight, and thickness. The larger the diameter the deeper the tone, hight and thickness remaining unaltered; the thinner the metal the deeper the tone, diameter and hight remaining unaltered. The German bell founders adopt a kind of average rule, maintaining certain ratios between the diameter of the mouth, the diameter of the head or upper part, the hight, and the thickness of metal; and a certain ratio between the weight of the bell and the weight of the clapper. In this way they can make a pretty good guess beforehand at the tone which a bell will yield. English bell founders have ratios of their own, which they regard in some sense as trade secrets. In practice, however, there are often unforeseen and unexplained difficulties in the matter; the Royal Exchange bell, for instance, is said to have failed in yielding either the pitch or the quality of the tone intended. By filing or chipping away some of the metal at the thickest part, called the "sound-bow," where the hammer or clapper strikes, the tone is deepened; whereas by reducing the diameter of the lower edge it is raised. The Great Tom of Lincoln, though smaller than the great bell of St. Paul's, is heavier, on account of its greater thickness, and yields a higher tone. Connoisseurs in bell science aver that modern church bells do not throw out such rich penetrating sounds as the bells cast many centuries ago; and they attribute this to the pernicious craving for cheapness which is now besetting us. A thin large bell will yield a note of the same pitch as a smaller bell containing greater thickness of metal; but the tone is poor and meager. The monster bell at Moscow, which is estimated to weigh four to five hundred thousand pounds, never had the good fortune to be hung up, and therefore its exact pitch cannot be accurately stated. In fact it can only have a crazy pitch at best, seeing that there is a broken gap in it nearly as large as the side of a small room. When Dr. Clarke was in Russia, he asked permission to assay or analyze the metal of which the bell is composed, to ascertain whether silver is one of the components, in accordance with a popular theory; but his request was not complied with. About thirty years ago, however, the late Emperor Nicholas caused an analysis to be make; when it was found that the metal consists of about six copper to one tin, with scarcely any trace of other ingredients. The bell now forms a sort of roof or dome to a tiny chapel excavated underneath it, in the pit where it was originally cast. As to small bells, the makers are accredited with the observance of certain rules for shape, size, and thickness, according to the purpose to which each kind of bell is applied. In the days when the postman's bell, the dustman's bell, the muffin bell, and the crier's bell, made a greater clatter than they do now, each kind was said to have a uniform tone or pitch; and it may be that some such uniformity is observed in the railway bell, the dock bell, the ship bell, the ostler's bell, the sheep bell—though we cannot vouch for it.

As the sound of a bell may be made of any pitch that the maker pleases, it is obvious that all the notes for an octave, or for many octaves, may be produced; and a set of bells thus becomes a musical instrument. At Antwerp there is (or was) a set of thirty-three in the cathedral tower, well attuned, and giving forth brilliant sounds. Such sets of bells are called carillons in many parts of the Continent. They are played something like a pianoforte. The player thumps (for mere pressure will not do) on keys, pellets, or movable pegs; these keys are connected by bands or rods with hammers, and the hammers strike the bells. For the bass notes, the feet tread on pedals; but the treble notes are played by hand, the player protecting the edge of the palm with a leathern shield. Some of the carillons have as many as fifty bells; and some are played by clockwork, like the Apollonicon of former days. The name carillons is occasionally given to the tunes played, as well as to the instrument itself.

BRITISH RAILWAY SIGNALS.

Nearly a million persons travel every day on the railways of Great Britain. At nearly every station junctions are formed with other lines, branching hither and thither in every direction. It has thus become a matter of absolute necessity that railway points and signals should be so co-related that no contradiction can occur. In the Scientific American, July 16, our London correspondent referred to the method in use on the English Railways. We have since received from him the following particulars of Messrs. Saxby & Farmer's system, which is used in nearly every railway in the United Kingdom:

The lines from Cannon street terminus, near London Bridge, running to Charing Cross, take circular sweeps, forming a junction near the Borough Market. The lines so joined, as well as others parallel to them, run across an iron bridge, which connects the Surrey side of the Thames with Cannon street Station. Along the bridge run four main lines and one engine line; in all five pairs of rails.

Between and among these lines are numerous curves, cutting across and effecting junctions with the main lines in every direction, and so furnished with points that trains can be run from any one line to any other, as may be required.

The five principal lines, as they approach the station, spread out into various branches; so that altogether nine lines enter the station, one to each of its eight platforms, and the ninth for the accommodation of locomotives. These branches have also their points; and it results that on the bridge and at the station there are in all thirty-two pairs of points, which serve to guide locomotives to and from the several platforms and along the various routes which communicate with them. The existence of all these branches necessitates signals, the chief of which number sixteen for up-lines and eight for down-lines, besides five distant signals and six subsidiary signals, making a total of thirty-five signals.

The number of operations which these points and signals have to conduct may be understood from the fact that at the most crowded time of the day eighteen trains arrive and eighteen depart within the hour. The locomotive which brings a train in is at its head, and consequently at the inner end of the station. To bring the train out again, the first locomotive is detached from the inner end, and another locomotive is attached to its outer end, and when it has drawn out the train, the supplanted locomotive moves leisurely out from the platform and waits quietly by to supplant in its turn a brother locomotive, on the arrival of a succeeding train. In this way for every arrival and departure there are required two movements of locomotives; and thus in the crowded hour, no less than 108 operations of shifting points and signals have to be performed; or, on the average, one in every thirty-three seconds.

To sum up, we find that thirty-two pairs of points and thirty-five signals—some of them 200 yards distant—have to be worked, sometimes to the extent of 108 operations per hour, and generally from eighty to ninety.

Across the bridge, and some fifty yards in front of the station, a platform is erected spanning all the lines at a hight sufficient to clear the chimneys of the locomotives. On this platform stands a glass house surmounted by four tall poles, from either side of which project semaphore arms to the number of twenty-four. These arms generally remain in their horizontal attitude, to signify danger, and are only occasionally lowered, and that but for a few seconds, to signify that the passage is clear. With others at a distance, they command all the lines and sidings on the bridge and in the station, and every driver of a locomotive arriving, departing, or changing line, has to keep his eye steadily upon some of them, stopping without fail when their warning blocks his way, and moving without fear when they promise safety. He easily distinguishes which of the signals belongs to the line he occupies for the moment; for they are arranged to right and left, and in altitude, in the manner corresponding to the arrangement of the lines themselves. If, then, the engine-driver does his duty, and if the signals properly point it out, no accident can happen.

Climbing by an iron ladder to the signal platform, we enter the glass house, which is about fifty feet long and six feet wide. One half of the width is occupied by a row of strong iron levers standing nearly upright from the floor, and placed at equal distances along the one side of the apartment; the rest of the width forms a gangway or passage from end to end for two stalwart and serious-looking men, whose time is entirely occupied in looking through the glass side of their cell, and pulling this way or pushing that way some of the levers which are arranged before them. These levers work all the points and signals, and on counting them their number is found to be sixty-seven, viz.: thirty-two point and thirty-five signal levers, corresponding exactly with the number which we ascertained before ascending the platform. Every lever is numbered, and on the floor beside it there is fixed a brass plate engraved with its name and use. Sets of them are also distinguished in a way that readily catches the eye, by being painted in strong colors. Thus all the point levers are black, the up signals are red, the down signals are blue, and the distant signals are yellow. The row of levers thus presents a diversified pattern to the eye which is readily caught by the parti-colored groups, and, having once got the key, distinguishes quickly and correctly between their different classes.

On examining the levers somewhat more closely, it is remarked that many of them have numbers painted on their sides, not one number only, but in some cases half a dozen or more. These numbers involve the whole secret of the safety which is secured by the mechanism. The signal man cannot open the points to one line and at the same time give a safety signal to a line which crosses it. When he gives a clear signal for a main line, he cannot open a point crossing to it; when he gives a clear signal for a crossing, he must show danger for all the lines which it crosses. And this is the meaning of the numbers marked on the different levers: No. 10, let us suppose, has 5, 7, and 23 marked on its side. He may pull at No. 10 as long as he pleases, but he cannot move it till Nos. 5, 7, and 23 have first been moved; and so throughout the whole system. No signal lever can be moved to safety unless the point levers, corresponding to it, have first been moved; and no point lever can be moved while there stands at safety any signal lever that ought to stand at danger. Every lever is under lock and key, each being a part of the key which unlocks some of the others, and each forming a part of the lock which secures some of the others against possible movement, while each is at the same time subject to the control of all those which are related to it.

This result, complex and difficult as it seems, is achieved by mechanism of great simplicity and beauty. Immediately under the floor of the platform, and just in front of the levers, are arranged several series of vibrating and sliding bars, somewhat like the tumblers of a lock placed horizontally. These bars have projections here which stand in front of certain levers as obstacles to their motion, or notches there which permit certain levers to travel. Some of them have sloping faces such that, when a lever moves along them, it edges them to one side, and this transverse motion being communicated to others of the series, brings the proper projections or notches in front of those other levers to which the moving lever is related. Thus, by the movement of one lever, some others are stopped and some are left free; and this simple principle, carefully applied to all, works them into a system incapable of discord.

The locking apparatus of points and signals is not excepted from the general law of degradation. So skillfully, however, have Messrs. Saxby & Farmer worked out the system that the very wear of the material becomes an element of safety. The natural or normal position of all the signals, be it remembered, is that which indicates danger. If, then, through slackness of wear, the lever which works a signal should become partly inoperative, the worst that can happen is to leave the signal at danger. This may cause delay, because it may stop a train which might safely proceed, but it cannot involve danger; and throughout the whole mechanism this great principle is kept in view, to be safe under any circumstances—let cranks or slides wear, rods stretch or break, delay may ensue, but danger never.

We have stated above the number of operations that have to be performed in the crowded hour, a number exceeding one hundred; but the performance of these operations by no means tries the powers of the mechanism or oppresses the operators by excess of work, as may be understood from the fact that a train can be diverted from one extreme line to a platform on the opposite extreme—an operation requiring the movement of ten pairs of points and of all the signals belonging to them—in the incredibly brief period of twenty seconds. To do this on the old system, there would have been required one man at each pair of points, and several men at the signals, we need scarcely say at a large expense of time and money, and at an enormous risk to the passengers.

To railway companies a system which effects so great economy of time and labor is a benefit of no mean order; and to travelers by railroad, an apparatus which guides them with all but absolute safety to their destination, is a boon which entitles its inventors to be ranked as public benefactors.

New Developments in Adulteration.

In our last, says the Boston *Journal of Chemistry*, we referred to cream of tartar, without any cream of tartar in it, as one of the latest "dodges" of adulteration—if adulteration it could be called. We have since read of another sample of the same article which contained more than 90 per cent of sulphate of lime, and not one particle of bitartrate of potash. It would have been dear at five cents a pound, and was sold as "extra fine" at fifty-five cents.

There has also been a new development in the adulteration of coffee. People have flattered themselves that if they bought the coffee beans raw, and roasted and ground them at home, they were sure of having the genuine Mocha or Java; but artificial coffee beans are now made, like bricks, from a greenish clay, and the eye cannot distinguish them from the natural article. They are made in molds, a hundred at a time and cost about a cent a pound. When roasted they absorb the brown color from the genuine berries with which they are mixed, and the true and false are still indistinguishable. This admixture of clay is not injurious, as it settles to the bottom of the coffeepot, giving a literal significance to the term *grounds* as applied to that familiar sediment. The beverage is weaker, of course, but otherwise no worse; indeed, we suppose that some dietetists would say that it is all the better for the inert addition to what they consider an unwholesome decoction. The fraud may be detected by breaking open some of the raw berries and examining them closely, or by chewing them; or as some one has suggested, you can make a microscopic examination of the interior of each berry.

Cement for Leather.—A good water-proof cement or glue, for holding wood or leather, may be made by dissolving fine shreds of india-rubber in warm copal varnish. The material to be united should be made clean, and be perfectly dry at the time of applying the cement.

[From Chambers' Journal].

THE ARTISAN IN AUSTRIA, RUSSIA, AND SWEDEN

The industrial system of Austria is one of an antique type. Not very long ago, the only large manufactories in the country were in the hands of the large landed proprietors, or the Government itself; the latter not only holding the salt, tobacco, and powder monopolies, but possessing the largest mining properties in every province, and being at the same time the greatest manufacturer in paper, chemicals, and porcelain. Out of these conditions arose "that ancient hierarchy of labor," the Genossenschaft, or guild, to which every Austrian workman is bound to be affiliated. Every trade has its special guild, the members of which are divided into three ranks—the upper, of masters; the middle, of workmen; and the lower, of apprentices. Any one desirous of entering a trade can only do so by enrolling himself among the apprentices of the guild of the particular craft he selects, paying thereupon the fee of three florins (nearly $1·50), one third of which goes to the funds of the guild, the rest passing to the Chambers of Commerce and Industry for the weekly lectures and Sunday schools they provide for the instruction of apprentices. The apprentice is then assigned to a master, whom he has to serve without payment for two, three, or four years. If at the end of that term he obtains a certificate of proficiency from the schools he has attended, his master proclaims him a free member of the guild, and he is registered as a workman on its books—the registration costing him another three florins. In return for a quarterly payment of twenty-eight cents he becomes entitled to gratuitous board, lodging, and medical care at the hospital during sickness, or to receive the same at his own home, at a charge of eighty-seven cents a week. If the workman wishes to become a master, he pays twenty florins to the Master's Chest, six florins for a diploma, and a little less than half that amount to the town rates, and receives the coveted promotion, and becomes an elector of his guild.

The guild system, whatever be its faults, turns out good workmen, who command, according to the German standard, good pay; for example, shoemakers earn $6 a week; joiners, $7·50 to $15; tailors, $6 to $9; silversmiths, $3·50 to $5; compositors, $6; meerschaum carvers, $4 to $9; plumbers, $4; and smiths, $6 to $9—twelve hours being the average working day. As to the food and lodging of the Austrian artisan, little can be said, as the information at hand is very scanty. In Vienna, where house-rent is very high, it is difficult to obtain a small room, with the use of a kitchen, for $48·00 per annum. About seventeen per cent of the industrial population are provided with lodging by their employers, some few of whom build houses, which their workmen buy gradually with the rent they pay. Thirteen per cent are wholly or partially boarded by their masters; some receive gardens rent free; and in some factories, the hands obtain food at wholesale prices. The owner of every large factory is bound by law to maintain, either with the co-operation of his work-people, in partnership with other manufacturers, or at his own expense, a permanent fund for the relief of those stricken down by accident or disease. Strikes, lock-outs, and all combinations for the restraint of trade being illegal in Austria, what we call trades' unions are non-existent there; but co-operative associations flourish, their number having quadrupled in the two years ending 1868. Of the 671 associations then in being, 418 were loan and discount banks, 237 co-operative stores societies, and 16 wholesale produce associations. Disputes respecting wages, work, contracts, and claims upon benefit funds are settled by Boards of Conciliation and Courts of Arbitration, consisting of twelve or twenty four members—one half employers elected by employers, the other half workmen elected by workmen; the latter being paid, while sitting in judgment, by the commune.

In 1869, national education was made compulsory in Austria. By this law, every child must attend school from the age of six to that of fourteen, and even beyond that age, unless it is certified that he has acquired the full minimum of education considered necessary for every citizen. The course consists of reading, writing, arithmetic, a sound knowledge of the native language and the native history, geography physical science, geometry, singing, and athletic exercises. Children employed in factories are exempt from attendance at the communal school, provided that they obtain the required amount of education at a special school of their employers; and wherever a special trade school exists, an employer is obliged to send all his apprentices to it. At the same time, every child is provided with religious instruction in the creed in which he or she is born, the local authorities of the religious community to which the child belongs being bound to provide competent certified teachers; upon their default, the state steps in, and undertakes the duty for them. This religious instruction is kept apart from the secular education, and is not permitted in any way to interfere with it. The future of the Austrian artisan promises well, for even without such advantages as the rising generation will enjoy, he is a credit to his country. Mr. Lytton was astonished by their culture and refinement. He says: "I have never yet met with any of the better class of Vienna workingmen unable to read and write correctly, or ignorant of at least the the masterpieces of the literary genius of Germany. . . . On subjects of political and economical science, the Austrian workingman is probably worse informed than the English. I must, however, bear witness to the fact, that at workingmen's meetings in this city I have frequently listened to speeches delivered by workingmen with an eloquence of utterance, a correctness of expression, and a dignity of gesture which would be effective in any public assembly. As the German race is not remarkable either for natural eloquence or natural grace of manner, I cannot but attribute this fact to a certain degree of culture. But to what must that culture be attributed? Where and how has it been acquired?

Mr. Lytton answers his own question in a way that may shock some good folks, but it is very suggestive. "The Austrian workman's daily life is subject to the incalculable influence of two great agents of refinement—the theater and the concert room, music and the drama. The stage is still an active educational agent throughout Germany. The drama is still regarded by German critics as the noblest province of poetry, and dramatic success is still valued by men of literary genius as the worthiest and widest on which they can rest their reputation. It consequently happens that the intellectual pabulum provided for the Austrian workingman by the theater, which he so passionately loves, and so faithfully frequents, is the master-work of all the great poets, thinkers, and men of letters from Goethe down to the present day.

"A curious illustration of the love of the lower orders in Austria for dramatic representation is afforded by the crowds, composed entirely of poorer classes, which may daily be seen waiting with great patience and good behavior about the doors of the best theaters in Vienna hours before those doors are opened. It is the same as regards the opera houses; good performances of the works of the best composers are abundant and accessible to all classes at a comparatively trifling expense. At the numerous places of recreation frequented by the Austrian workingman, the chief and most general source of recreation is music—never very bad, and often very good. There are very few Austrian workingmen who cannot either sing or play on some instrument, and who do not belong either to some amateur orchestra or singing club. A certain supply of *bonâ fide* amusement, and relaxation of mind as well as body, is regarded by most of them as a legitimate and necessary part of their annual expenditure. And it is to the humanizing influence of this view and habit of life, rather than to any innate peculiarity of temperament, that I am disposed to attribute the geniality and kindliness of disposition, as well as the refinement of manner, which have so greatly struck me in my occasional intercourse with the Viennese workingman." After this, we are not surprised to learn that intoxication is rare, habitual drunkenness very rare among Austrian artisans, and that their ideas of intimidation are confined to sending their obnoxious fellows to Coventry.

The condition of the Russian artisan is said to have materially improved of late years, but there is plenty of room for improvement still. Owing to the climate and the severity of the winter, employment is at the best precarious, and a goodly proportion of the working-classes pass their time alternately in the towns and the country, flocking into the former with the spring, and returning to their villages as autumn draws to an end. Wages vary according to locality and the season of the year, and are lowest in the districts where hand-loom weavers congregate. Good mill hands in the cotton, silk, linen, cloth, nad carpet trades receive from $7·50 to $15 per month; ordinary mechanics, joiners, blacksmiths, etc., are paid from 75 cents to $1·50 a day; while skilled mechanics and engine drivers can earn $1·50 to $2 50, or even more Thirteen hours, with one for dinner, and a short rest for breakfast and an evening meal, is the averrge working day; that for children, of whom, however, very few are employed, being no shorter. All engagements are verbal, and cannot be broken off at less than two weeks' notice. No workman can be taken on at a factory or workshop unless he is able to produce a properly viséed passport.

Some of the mill hands live in huts like those used by the agricultural laborers, and constructed after the following fashion: Logs of red pine are cut into lengths of three, four, or five fathoms, according to the size of the house. These are placed one above the other, and the ends dovetailed together. The doors and windows are then cut out, and the pieces carefully numbered by notches, and the box of logs taken to pieces preparatory to the actual building commencing. This operation consists in placing the lowermost tier on a foundation of wooden posts and boulder stones, adding tier after tier, filling up all the interstices with moss, or hemp and tow. The walls finished, floors and ceilings of red or white pine boards are added, both floor and ceiling being double, with a layer of earth between, and the whole crossed over with boards. The hut is roofed with wooden tiles In one corner of the room—there is seldom more than one—a large brick stove, like an English baking oven, is built, a chimney of wood, or of bricks put loosely together without mortar, is carried through the roof, and the house is ready for occupation. In large towns, however, the mill hand may lodge in large two or three storied houses, but comfort and cleanliness are out of the question. The rooms are small, low, and ill ventilated, and expected to accommodate as many as they will hold both for living and sleeping purposes—shelves and benches doing duty for beds. Except in the case of overseers and foremen, separate sleeping rooms are never thought of; and all are overcrowded. Some few manufacturers have erected large buildings, wherein the married, the single men, and the single women are separately provided for; a single man paying from 75 cents to $1·50, and the married man, from $1·50 to $2 00 per month as rent, the rent being deducted from his wages. Attached to these buildings there is usually a store, under the master's control, for the sale of good provisions at reasonable rates. In the poorer districts the food of the working classes is wretched in the extreme, costing about $1·13 a head per month, and quite enough too, since it consists of black bread, water, and a little tea occasionally. In the large towns it costs the artisan as much per week, but then his dietary is more extensive, consisting of black bread, fresh and salt fish, cabbage and meat soup, cucumbers, mushrooms, and potatoes; washed down with tea, quass, and corn brandy. In Moscow and St. Petersburg, beer is indulged in; but that beverage finds small favor elsewhere, the cheap corn brandy being the prime agent in liquoring-up among the workingmen who call the Czar father.

The sum of $4·25 is given as the average weekly wages of good workmen in good trades in Sweden, piece workers, however, making twenty-five per cent more. In Stockholm, where the wages are highest, the following are the ruling maximum rates: Goldsmiths, $7; watchmakers, $5·50. mathematical instrument makers, $7·50; pianoforte makers, $5·25; tanners, $4·13; paper makers, $4·50; while cotton weavers seldom make more than $1·75 a week—thirteen hours, less one for dinner, being reckoned a day's work. Miners and ore smelters, receive a large proportion of their wages in the shape of provisions, any fluctuations in the market prices of necessaries being equalized by a proportionate increase or decrease of wages; rye bread, vegetables, oatmeal cake, salt herrings, smoked pork, milk, and cheese, forming the principal portion of their dietary. In Stockholm, the artisan can get a decent dinner of meat, bread, and vegetables at a moderate price, and is able to indulge in spirits to a greater extent than is desirable. In the rural districts of Sweden, almost every mine, smelting house, or factory of any size has near it houses specially designed for the use of the workmen—neat little wooden cottages, with gardens and vegetable grounds; and many proprietors permit these to pass into the actual ownership of the occupiers, taking payment by installments—no very heavy tax upon the resources of the would-be house-owner, since any careful industrious man is held to be able to save at least one third of his income. In the large towns detached cottages are not possible, and the lodging house system is extensively adopted. At Nordköping, each house of this sort has a basement, first floor, and attics, providing lodgings for twenty-four married couples, each lodging comprising one good-sized room, a larger kitchen, a small spare room, and spacious cellars for wood and fuel; and so arranged, that only two sets of rooms have the same entrance door. The attics supply space for a reading-room, and four chambers for unmarried men; while in front of the building is a piece of ground divided into allotments for the cultivation of flowers. At Gothenberg, a town distinguished for its efforts to house its artisans comfortably, the commune has erected, at a cost of fifteen thousand dollars, ten one-storied houses, each containing seven sets of apartments of two rooms and a kitchen, twenty-one sets of one room and a kitchen, and fourteen single rooms; the rents of these varying from $1·25 to $3·13 per month; and in another building the authorities provide accommodation for thirty-two families and forty-eight single lodgers. In the same place, a local Peabody gave a sum of $90 000 towards the erection of a superior class of lodging houses, by which four hundred and thirty persons are housed— whose moveable property is insured for nearly $25,000. Such dwelling as these, of course are inhabited by the better class of workmen; second rate ones having to content themselves with sharing a room and kitchen in houses of a humbler description.

By the law of Sweden, every engagement must be made in the presence of witnesses, and a written agreement drawn up, defining both its conditions and duration; but the latter must not exceed three years. "Masters in trades or other industrial pursuits shall provide with fatherly care that the assistants or workmen in their employ (especially those who, being minors, board and lodge in their houses) be encouraged in habits of piety, regularity, and morality; and that such as have not acquired the minimum degree of knowledge prescribed by the national school regulations, receive instruction on such days and such hours as they shall determine; and further, that their assistants or workmen diligently attend the technical Sunday schools, where such are established, or other places of instruction intended for the improvement of the industrial classes." By another section, masters are bound to give due consideration to the health and capabilities for labor of those whom they employ. Workmen's societies for mutual aid in sickness have long existed, but what we know as trades' unions are of very recent date there; and such as exist are devoted rather to co-operative manufacture, or the intellectual improvement of the members, than to attempting to control the labor market. The Workmen's Association of Nordköping is the most prosperous among these useful organizations. In 1867, it numbered 1,519 members, and in seven years had spent $4,500 in assisting sick members, and $1,000 in defraying funeral expenses. It has a building of its own, built at a cost of $22,500, the plans being drawn, and the edifice constructed by members only. This Association boasts not only of a library, but a theater of its own, and has in connection with it a co-operative society for the supply of necessaries, and a society of production for manufacturing articles on the co-operative system.

REVENUE STAMPS.—According to the report of the Chief of the Stamp Division of the Internal Revenue Bureau, the number of document stamps printed in the fiscal year, ending June 30th, 1869, amounted to 118,011,244, and in the year ending June 30th, 1870, to 130,295,141. Notwithstanding the increase in the number of stamps the Government has realized $66,131 less in 1870 than in 1869. The falling off if attributed to the lessened demand for stamps of the higher denominations. The increase in the sale of stamps has been confined to the lower denominations ranging from two to fifty cents, as greater attention in late years is paid to stamping receipts and checks, and the increase in the sales of the lower denominations amounting to over nine millions of stamps. The stamps for proprietary medicines, cosmetics, etc., printed in the year ending June 30th 1869, amounted to 269,000,000, and in the year ending June 30th, 1870, to 298,000,000, yielding a gain of $433,171. The stamps imprinted on checks and documents give an increase of nearly $200,000 over the receipts in 1869.

Improved Brick Machine.

This machine, which was patented February 23, 1870, by the United States Brick Machine Co., of Chicago, Ill., has been brought to New York and is now on exhibition at the rear of 59 Ann street, between the hours of 9 A. M., and 4 P. M., each day.

We have never seen a brick machine equal in simplicity to this one. In it the inventor has accomplished what has hitherto been deemed an impossibility, the working of all the parts on the shaft of the ordinary pugmill. The machine can be driven by a lever sweep propelled by horses as well as by steam or water power, though when driven by horses it cannot, of course, be worked up to its full capacity, the latter being limited only by the practical speed of the machine and ability to supply it with clay.

It has been found that in practical working a speed that will turn out 60 to 70 bricks per minute, is about what can be done with two men to shovel in the clay, no attendance being required except to shovel the clay into the pugmill and hack up the bricks as they are carried away by an endless apron.

All the well-known principles of good brick making are observed in the operation of this machine. The pugmill operates precisely like the old pugmill, tempering the clay before pressing it in the molds. The pressure is adjustable to compress the bricks more or less, so that the proper density may be secured. The bricks may be pressed so as to be hacked up immediately. The commonest clay may be used, and it is claimed that as perfectly-formed bricks are made on it as can be done with the same quality of clay on a hand machine, that on subsequent baking the poorer sorts of clay will yield on the average enough perfectly-faced bricks for the fronts of ordinary buildings, while with the finer clays bricks of the finest finish may be made at the same rate as coarser ones.

The machine is driven by a powerful and heavy gear placed below and on the shaft of the pugmill. This gear is driven by a pinion on the pulley shaft, which takes its power from an engine or water wheel. If the mill is impelled by a lever sweep from the top of the shaft no toothed gears are necessary.

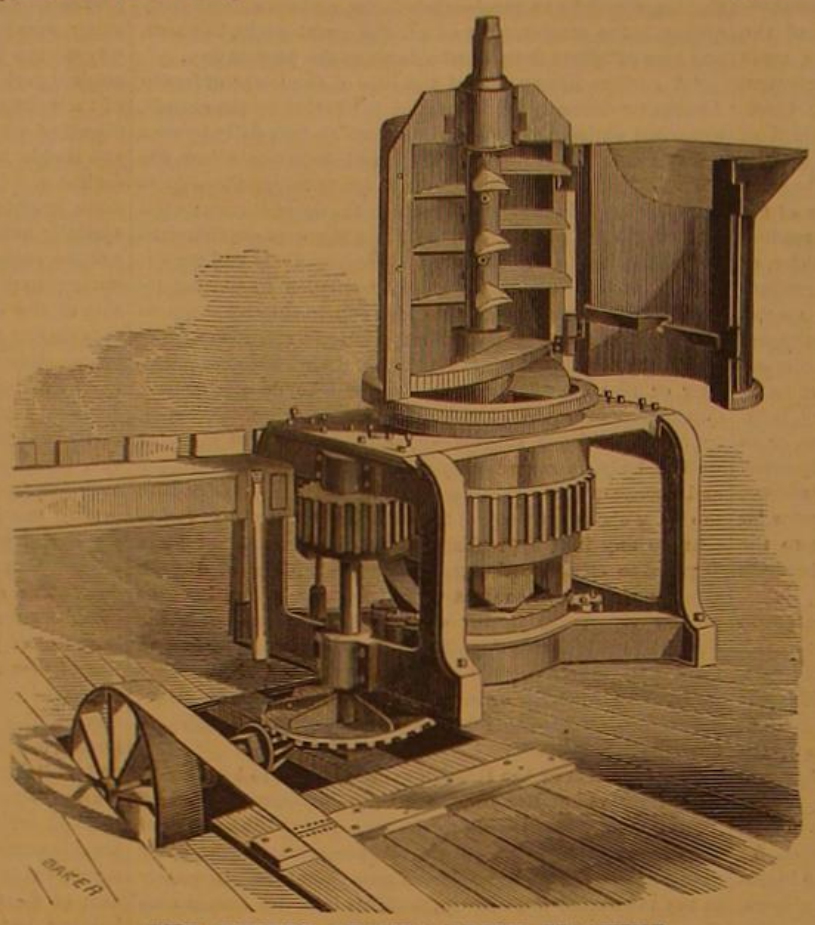
In the body of the large gear are formed, at proper intervals molds which receive the tempered clay from the pugmill as it is forced down into them by a powerful propeller screw fastened to the shafts below the knives, which do the grinding and mixing. In each of these molds—which are steel-faced—runs a steel or brass-faced follower, having at the bottom a roller wheel, which rolls up in a fixed track, elevated at the proper points, the action of which is to force the follower up, at the proper times, to compress the bricks, and also to thrust them out of the molds when they have arrived at the proper point of the revolution. As the bricks are thrust up out of the molds they pass on to an endless belt or apron, and are conveyed away to be hacked up.

There is nothing whatever about the machine which can get out of repair. Its parts are few in number and so constituted and arranged that they can be made of a weight and strength which insure their power of endurance, and no skilled attendance is required to run it. All the work can be done by boys except the shoveling of the clay.

Any complication liable to interfere with the perfect and permanent operation of the machine or to lessen durability is avoided.

We have seen it practically at work, and think it will do what is claimed for it. We certainly have never before seen bricks produced more rapidly, more perfect in shape, or more uniformly pressed than is done by this machine.

Machines can be seen practically at work, at the Company's yards in Chicago, at 59 Ann street, New York, and 120 Fulton street, Boston. Address F. C. Wells, President, U. S. Brick Machine Co., Chicago, Ill., for information.



THE UNITED STATES BRICK MACHINE.

Paper from Oat Husks.

W. Hay, of Glasgow, Scotland, has just patented the following process. He first immerses the oat husks in water in a tank or other convenient vessel, in order to float off mustard and other seeds with which they are generally more or less mixed, and which if not separated, materially deteriorate the quality of the paper. It is of advantage to have the water well stirred, as it facilitates the separation of the foreign seeds and allows them to float to the surface. The oat husks are then allowed to settle, and the surface scum and floating seeds are drawn off by an overflow pipe at the top of the tank, or skimmed off by a rake or other tool, or otherwise removed, after which the water is drained from the oat husks by a waste water pipe at the bottom of the tank, and beneath a perforated false bottom, or fitted with a strainer which retains the oat husks. The oat husks may be left to steep in the water for from five to ten hours after or during the removal of the scum, as this steeping, by softening them and helping to loosen the silica from the fiber, facilitates the subsequent boiling process. The remainder of the process does not differ materially from the ordinary one in making paper from straw.

Alum in the Printing Bath.

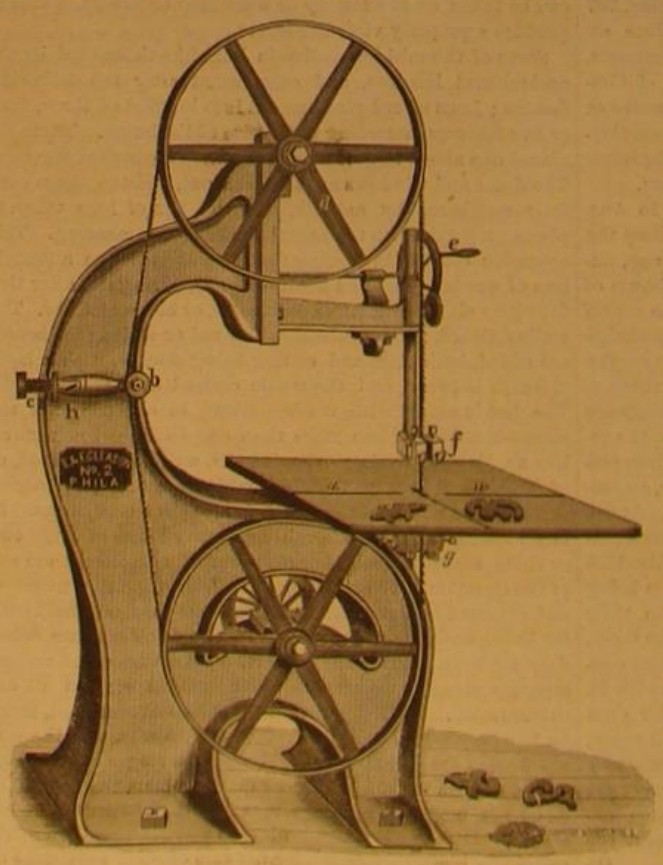
It having occurred to me, some two months ago, to try a combination of nitrate of silver and alum for a printing bath for albumenized paper, I made an experiment on a small scale, which was very satisfactory. I subsequently introduced it at our printing department, and for the last two months it has been used with good result. I cannot claim that the prints are any more brilliant, but there are other advantages of importance. Every photographer knows how invariably a scum forms upon the surface of a silver solution which is not constantly used. By the use of alum this scum is entirely prevented, the double solution appearing to have the quality of more perfectly and thoroughly coagulating the albumen. As a consequence of this the paper keeps its whiteness in hot weather much better than where the simple silver solution is used. The toning is effected with equal ease, and the whites (on the Steinbach paper) much better after fixing.

In preparing the silver solution, it is merely necessary to add as much powdered alum as it will dissolve. As we have not tried this solution on a variety of papers, it will probably be as well for experimenters to try it on a small scale at first. —*Anthony's Photographic Bulletin.*

GLEASON'S IMPROVED BAND SAW.

Our engraving represents Gleason's improved band saw, of which the following is a brief description:

The frame or stand is all iron, and is, by its peculiar design and great weight, necessarily very stiff and strong, a feature very desirable in a band saw, not that it is required or expected to do heavy sawing, but because it has been found by experiment that a light and delicate frame in a band saw is one of the principal causes of the breaking of the saw.



As this class of machinery is generally placed on second or third floors, and sometimes higher, where the foundation is poor and shaky at the best, as a matter of course the frame will shake and tumble with the floor, and unless the frame is made heavy and substantial, the top part of the frame will move and tremble independent of the bottom. This will cause a constant jerking or irregular straining of the saw, under which no saw can run but a short time before breaking.

The arrangement, *c h b*, for holding the saw steady on the slack side, is considered much better than the plan usually adopted, as it not only keeps the saw steady, but by means of the spiral spring, O, it allows for contraction and takes up the expansion of the saw. It also, by means of wheel, *b*, answers the purpose of guiding or leading the saw on different parts of the wheel, which can be done by simply turning the guide wheel, *b*, up or down; a small part of a turn being sufficient to cause the saw to run to any part of the wheel desired. This arrangement obviates the necessity of stopping the machine and setting the top wheel out of level or plum with the bottom wheel, thereby twisting the saw more or less and increasing the liability to break.

It often occurs that a chip or block gets in between the saw and lower wheel, in which case the extra strain brought on the saw will be the means of breaking it, a thing impossible when the arrangement, *c h b*, is used.

The guide, *f*, is adjustable to different widths and thicknesses of saw, and will guide and hold the saw from twisting, when cutting on small circles. The guide is so arranged that it never interferes with the teeth or set of the saw. The wheel, *d*, is adjusted to different lengths of saws by the hand wheel, *e*, which is within convenient reach of the operator. The table is iron, and has two T-grooves, *a a*, by which a gage or fence can be attached for straight sawing. There can also be a radius sweep attached for cutting a regular circle without lines in sawing fellies, chair backs, rockers, etc. This table has a ball and socket seat (not found in other saws), which permits bevel sawing, or cutting a tenon on a leg for a frame that requires to be spread at the bottom.

Both the shafts have long and substantial journals, the top being 8 in. by 1 $\frac{7}{16}$, and 12 in. by 1 $\frac{9}{16}$, and then run in the Babbitt-lined boxes, that can be tightened up as they wear. With each machine is furnished one saw and a brazing apparatus. For further information address E. & F Gleason, No. 27 Haydock street, Philadelphia, Pa

Use of Metals as Fuel.

An English inventor proposes to substitute metals for coal as fuel for ocean steamers, and has taken out a patent for a method of carrying out his views, his object being to obtain a larger amount of steam from a given quantity of fuel.

When coal is burnt the solid coal is turned into gas, a large portion of heat becomes latent, and is wasted by volatilizing the solid. The oxygen of the atmosphere is a gas by reason of the large amount of heat combined with it. When zinc, iron, or manganese are burned, the resulting oxide is a dense solid; little or no heat is wasted, as it is not turned into vapor In addition to this, the inventor obtains the cosmical heat latent in the oxygen of the atmosphere, and the result is that one pound of zinc will evaporate more than four times as much water as one pound of coal, the advantage of which, on long sea voyages is obvious The zinc or other metal thus becomes a vehicle of power, much larger than can be obtained from the same weight or bulk of coal, and the oxide of the metal may subsequently be economically reduced at any convenient place where coal is accessible. The following is the manner in which it is preferred to carry out this invention: The furnace of the boiler is divided into two or more parts, first, the hearth or grate on which the metal is burned (in this description we will confine ourselves to the metal zinc); secondly, a chamber behind the hearth to collect the oxide. In the case of tubular boilers, the heated gas from this chamber is made to circulate through the tubes. The furnace has the bottom and sides, and sometimes the top also, of brick, fire-clay, or any other refractory substance. The air is admitted over the combustible metal, or by a blast through the same; in the latter case pipes or tweers are built in the bottom or sides of the furnace.

Whether this method prove practically successful or not, it is certainly based on sound principles. Every one knows what a small proportion of coal compared to the iron is used in the furnaces of iron founderies, and how the partial combustion of the iron itself increases the heat derived from the coal. If stoves could be built that would burn iron, it would doubtless be as cheap a fuel as coal, perhaps cheaper.

Effect of Hard and Soft Water on Health.—Neither hard nor soft water appears to exercise any perceptible influence on the tables of mortality, Both are apparently equally wholesome as far as the death-rate is concerned, though many painful diseases which are not fatal are with reason believed to be aggravated by the use of hard water. While it is most conclusively shown that soft water is not injurious to health, the economic benefits which attend its use are so striking and so great, that happy indeed those people may consider themselves who have the advantage of soft water. The softening of hard water for manufacturing purposes is not difficult.

Improvement in Millstone Picks.

This invention supplies a means whereby the steel bit of a millstone pick may be firmly secured in its position, readily detached when required, and adjusted as it is worn away.

Fig. 1 is a perspective view, and Fig. 2 a sectional view.

A is a wedge-shaped plate which is attached to the handle by a screw shank, B is a piece of metal made so as to partly fold about A, as shown, but leaving a space between A and B, in which the steel bit, C, is held, by a lug being formed upon it, which fits into a corresponding recess in the plate, B, as shown in the section, Fig. 2.

It results from this arrangement that blows upon the bit, C, in dressing a stone, more firmly clamp and hold the parts together, while to loosen them, all that is necessary is to tap the plate, B, on the end opposite the cutting point or edge, which unwedges the two plates and releases the bit.

Two recesses are provided in the plate, B, so that when the bit is worn down, it can be set further out from between the plates, A and B. When one end of the bit becomes so worn as to be no longer available, the bit is reversed, and the other end applied to dressing the stone. Thus the bit may be used until it is almost entirely worn away. It is retained firmly, and yet is instantly detached for sharpening or for adjustment.

Fig. 1

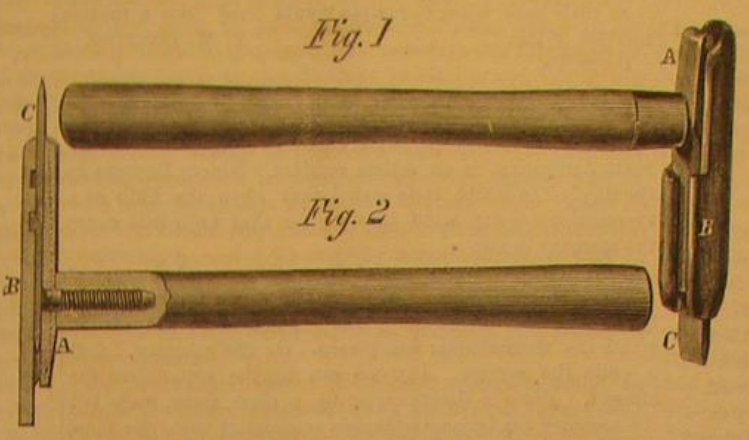


Fig. 2

CROSSLEY'S IMPROVED MILLSTONE PICK.

Patented, February 20, 1866, by Charles Crossley. For further information, address C. K. Bullock, 1,128 Market st., Philadelphia, Pa.

[For the Scientific American].

THE SCARABÆIDS--THE FLOWER BEETLES AND THEIR ALLIES.

[By Edward C.H. Day, of the Schoolof Mines, Columbia College].

The family of the Scarabæids is probably of very ancient extraction. We have no geological evidence to offer on this point but we infer the fact from the very great development of the group and from the variety of pursuits that different branches of the family have adopted. It is only one division, the Coprophagi, or dung beetles, that have taken to the scavenger business; another—the Melolonthians—are, as we have seen, notorious as marauders upon our vegetation; while a third group—the Cetonians and their nearest relatives—in their perfect state lead a life of luxurious idleness, feasting upon the delicate sweets of flowers and the rich juices of fruits, or upon the delicious saps that exude from the stems of plants. The various members of these subdivisions show strong family resemblances. A Scarabæid, whatever its mode of life, may be recognized "by its clubbed lamellate antennæ, the terminal joints being expanded into broad flat leaves, which, at the will of the insect, can be closely shut up into a compact club or loosely expanded fan-like."

From this form of antennæ (which were well shown in the engraving we lately gave, after Blanchard, of the cockchafer—*Melolontha fullo*) the family is sometimes known as the Lamellicornia. A Scarabæid is also generally recognizable "by its robust, thick, often square body, short fossorial legs, with large hooked claws for seizing leaves and stems."—(Packard). The Lamellicorns have attained to a great numerical development, and are widely distributed over the globe. In a catalogue, issued many years ago, of a single private collection, 2,300 species of this family were enumerated, and Packard tells us, in his recent work, that it now is known to contain some six thousand described species, arranged in about seven hundred genera. Among collectors of Coleopters, this is a favorite group, as it affords some of the largest insects that enrich their cabinets, while many of the tropical species are of extraordinary form, and many even of our northern ones are beautifully colored. Every one living in the country must be familiar with the bronze dung beetle (*Phaneus carnifex*), whose brilliant metallic tints green shot, with gold and purple, at once draw attention to it. The horn on the head of the male gives this species a still further attraction in the eyes of the curious. In warmer climates such horns occur on many of the large species, assuming much more extraordinary proportions and giving a very grotesque appearance to the insects.

The insect figured (from Blanchard's work) is a common European species, and is a good type of the Cetonians or flower beetles. Its scientific name (*Cetonia aurata*—gilded cetonia) is derived from its coloration—a rich emerald green with golden reflections. The perfect insect lives upon flowers, eating their petals and imbibing their nectar, and, as its popular name of rose-beetle implies, it is particularly partial to the queen of flowers. Its larva—like all those of the Lamellicorns—is a thick fleshy white grub, and lives in decayed wood at the roots of trees and in ant-hills; at the approach of winter it buries itself deep in the ground. Like the grubs of the Melolonthians, these larvæ do not attain their full growth for several years; they then make themselves cocoons of fragments of decayed wood, cemented together by a gummy secretion, and in them pass into the chrysalis stage.

The *Euryomia* (formerly *Cetonia*) *Inda* is perhaps the most typical, as well as the most common of the Cetonians occurring in this neighborhood; though it is not remarkable for its size, being but little more than half an inch in length, nor for its color, which is a variable shade of brown speckled with black. A metallic luster in certain lights, somewhat relieves its otherwise dull appearance. As Harris remarks, this is "one of our earliest visitors in the spring." We find its first appearance this year, recorded in our note book, on the 15th of April. Its short, thick form, its hairy body and legs, and its peculiar humming flight, give it, as Harris adds, a strong resemblance, when on the wing, to a humble-bee. This resemblance is probably caused partly by the fact that the wing cases of the Cetonians do not open in flight; as these cases do not overlap the sides of the abdomen, as do those of other beetles, the hind, or true, pair of wings, can be unfurled without the elytra being unclosed. It is probable that this resemblance to a bee may serve to protect this Cetonian from foes that would otherwise attack it when frequenting flowers. At the close of summer the Cetonians re-appear, not only visiting flowers for their sweets, but very objectionably eating into our most juicy fruits. On the 10th of August last we captured one fairly burying himself in a large blackberry, but it is of ripe luscious peaches that they have the good taste to be particularly fond, and Harris says that he has taken as many as a dozen of them from a single peach. That writer also supposes that the larvæ of this Cetonian live upon the roots of herbaceous plants. To the Cetonians of warmer climates belong some of the largest of beetles—the Goliath beetles of Western Africa—some species of these measuring from three to five inches in length and being of massive proportions. According to authority quoted by Packard, these giants "are found in the tops of trees, where they feed on flowers and on sap exuding from wounds in the bark . . . . the natives obtain them by jarring the trees." It is said that they are also sometimes shot, when on the wing, like hummingbirds, with guns loaded with sand; nor need the reader turn up his nose at the results of such sporting, when he learns that from $150 to $250, gold, have been given in former times for single specimens of the rarer species! Owing to the more frequent visits of travelers to their haunts, specimens have become cheaper, but even now it is not within the means of poor students to have such interesting forms to study in their own cabinets.

This leads us to remark that in New York there is no public museum to supply this deficiency—no collection worthy of the name, to exhibit the varied natural productions of the earth, and to assist the scientific man—in a city which derives all her immense wealth from the application of science to every portion of the vast field of Nature. Scientific men lay the blame of this want upon the rich men of the community, or upon the city authorities, or upon any one else but themselves. We believe, however, that they are themselves most in fault; if they would for a few hours lay aside all thoughts of their own particular interests, cease to struggle for the supremacy of their respective half-alive societies, show themselves individually anxious for the general benefit, we might in three months inaugurate collections that in a few years would rival the oldest and most boasted collections of Europe. We should then be able to study objects even more expensive and more interesting, than the tropical Cetonians.

METAMORPHOSES OF THE ROSE BEETLE—(*Cetonia Aurata*).

Sleep, Fainting, Apoplexy.

When a man is asleep, his pulse beats and his lungs play, but he is without sense, and you can easily wake him up.

If a person "faints," he too is without sense, but he has no pulse and does not breathe.

Apoplexy is between the two; the heart beats, the lungs play as in sleep, and there is no sense, as in fainting, but you can't shake the man back to life.

In sleep, the face is natural.

In a fainting fit, it has the pallor of death.

In apoplexy, it is swollen, turgid, and fairly livid.

If a man is asleep let him alone, nature will wake him up as soon as he has got sleep enough.

When a person faints, all that is needed is to lay him down flat on the floor and he will "come to" in double quick time. He fainted because the heart missed a beat, failed for an instant, failed for only once to send the proper amount of blood to the brain. If you place the patient in a horizontal position, lay him on his back, it does not require much force of the heart to send the blood on a level to the head; but if you set a man up, the blood has to be shot upward to the head, and this requires much more force; yet in nine cases out of ten if a person faints and falls to the floor, the first thing done is run to him and set him up, or place him on a chair.

In apoplexy, as there is too much blood in the head, every one can see that the best position is to set a man up, and the blood naturally tends downward, as much so as water will come out of a bottle when turned upside down, if the cork is out.

If, then, a man is merely asleep, let him alone, for the face is natural.

If a man has fainted, lay him flat on his back, for his face is deadly pale.

If a man is apoplectic, set him in a chair, because the face is turgid, swollen, livid, with its excess of blood.

What is apoplexy? From the suddenness of the attack and the apparent causelessness of it, the Greeks connected it in their own minds with the idea of a stroke of lightning as coming from the Almighty hand; it literally means, "A stroke from above." As instantaneous as the hurling of a thunderbolt in a clear sky, there comes a loss of sense, and feeling, and thought, and motion; the heart beats, the lungs play, but that is all, and soon they cease forever. The Romans considered the person to be "thunder struck" or "planet struck," as if it were of an unearthly origin.

The essential nature of apoplexy is an unnatural amount of blood in the brain; whatever sends too much blood to the brain, may cause apoplexy; whatever keeps the blood coming from the brain, dams it up, may cause apoplexy; that is the kind of apoplexy which seems to come without any apparent adequate cause. Tying a cord tightly around the neck, or holding the head downwards too long, can bring on an attack of apoplexy, by damming up the blood in the brain, and keeping it from returning to the body.

A sudden mental emotion can send too much blood to the brain; or too great mental excitement does the same thing. It is the essential nature of all wines and spirits to send an increased amount of blood to the brain; hence alcohol is said to stimulate the brain.

The first effect of taking a glass of wine or stronger form of alcohol, is to send the blood there faster than common, hence it quickens the circulation; that gives the red face; it increases the activity of the brain, and it works faster, and so does the tongue. But as the blood goes to the brain faster than common, it returns faster, and no special permanent harm results. But suppose a man keeps on drinking, the blood is sent to the brain so much faster, in such larger quantities, that in order to make room for it, the arteries have to enlarge themselves; they increase in size, and in doing so, press against the more yielding flaccid veins, which carry the blood out of the brain, and thus diminish their size, their bores; the result being, that the blood is not only carried to the arteries of the brain faster than is natural or healthful, but it is prevented from leaving it as fast as usual; hence, a double set of causes of death are set in operation. Hence, a man may drink enough brandy or other spirits

in a few hours or even minutes to bring on a fatal attack of apoplexy; this is literally being dead drunk.—*Hall's Journal of Health.*

Correspondence.

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

American and Chinese Vermilion.

Messrs. Editors:—Probably no branch of American manufactures has increased so rapidly and attained so much perfection as that of the various paints and colors. But a few years ago all these articles—of any fine grade, at least—were imported; now increased home demand and the high tariff enable the manufacturer to experiment and expend, so as to bring them up to the highest standard, with a surety of a remuneration.

This improvement is especially noticeable in carmines and vermilions. For years all the quicksilver vermilion the world had, and it is by far the most brilliant and durable of reds, was brought from China. The English commenced its manufacture, but have never equaled that made by our neighbors of the almond eyes. It was left for American capital and energy, stirring up German brains, to accomplish this result.

A late number of the Boston *Journal of Chemistry* says: "The Chinese make from quicksilver that beautiful pigment, vermilion, which is so largely employed by painters and colorers in all parts of the world. It is singular that this half civilized people are able to prepare a chemical compound from quicksilver which is superior to, and which commands a higher price than the same salt produced in Europe and the United States, where the arts are carried to the highest perfection. English and American vermilions, as found in the market, are far inferior in brilliancy and quality to the Chinese."

The last sentence of this paragraph is what I would call attention to. The article from which the quotation is made has been extensively copied throughout the United States, and it is incorrrct. Messrs. C. T. Raynolds & Co., of this city, some time ago sent to various practical and scientific men samples of a quicksilver vermilion made by a new process, or an improvement on the old. The result of tests side by side with the famed Chinese, is equal durability of color with as great brilliancy and strength. We are aware that the impression has been that no one could rival the Chinese, and that scientific books, papers, and men have so stated, but it has been and is constantly done. In justice to the cause of American manufactures I ask a place for this contradiction in your columns. The extensive circulation of the statement can only thus be refuted, for it is not likely the mere denial in the *Journal of Chemistry* would be so extensively copied as the article alluded to. H. E. Colton.

Rubber as a Storehouse of Power.

Messrs. Editors:—I was very much interested in reading the description of Mr. Jones' method of propelling street cars by means of rubber, on page 105, present volume, of the Scientific American. Rubber in its various forms is manufactured into so many articles of every-day use that there seems to be no limit to its adaptability to human wants.

Now that its propelling capacities are proved, the farmers want a light motive power for various laborious operations that are now performed by hand. Had we such a power to run the straw cutter, fanning mill, etc., on the farm, and churn, sewing machine, dish washer, and clothes washer in the house, it would be the neatest thing in the world. I doubt if it could be used where much power is required, for the winding up of the machine would be no boy's play.

I should think it might be applied conveniently to a light road vehicle.

Why cannot Messrs. Hanlon apply it to the bicycle? I think it would rejuvenate the worn-out steed into new and *permanent* life. With a motive power all laborious kickings with our pedal extremities would be avoided. The feet could be exercised occasionally to wind up the power, or the steering lever, or the momentum attained in going down hill could be used for the purpose.

A light, graceful tricycle, with a seat for a gentleman and lady, propelled easily and rapidly along the highway, up hill and down, with little or no labor from the occupants, and sold at a moderate price, would certainly be a desirable and popular invention. Can Mr. Jones or any of our numerous inventors give us this desirable necessity? Who will be the first to apply the rubber band to road vehicles, and set them whirling upon our highways all over our broad country? Who will solve the question? J. H. M.

Hartford, N. Y.

Crystal Coaches for Railways.

Messrs. Editors:—Our railway coaches ought to be made with glass sides for several reasons. The peep-holes, so common now, ought to give place to windows 48×30 inches, consisting of the panes of glass 15×48 inches, in sashes arranged to slide by one another. One such window to a seat, with curtains of some comparatively inexpensive material for summer, while something warm and heavy might be provided for winter, would be far better than the clumsy shutters in use, besides being more homelike and tasty. Such a coach would be lighter in both senses. What a grand view would be afforded to the traveler from such coaches! How imperfect the perspective now—how perfect then. Now we must be content to gaze on panel, veneer, and daub, then we might gaze with unobstructed vision on all the light and beauty with which the Father has adorned this fair land of ours. All of the exhilarating effect of buggy riding is lost in these cages—cages, yes, cages of death in so many catastrophies. With the sides of glass few would be left in the wreck when it reached the bottom of some declivity, to scorch and burn as at Angola.

With the sides of glass, many would have escaped who sank beneath the surface of a river, to rise only in death, in cars transformed as quickly into capacious coffins.

With the sides of glass, how easily the elbows or the foot might open an avenue of escape in every case of danger. Many firemen and engineers have escaped death by jumping from their cabs, when to remain would have been a useless sacrifice of life. F. M. Horning.

Corry, Pa.

Effect of Air Currents on Thermometers.

Messrs. Editors:—In No. 7, current volume, of the Scientific American, is an article entitled, "Ninety Degrees in the Shade," in which it is stated that when the bulb of a thermometer is dry, wind blowing on that bulb will cause the mercury to rise.

Now, in all my experience of thermometers and changes of temperature of the air, I never saw it do so; unless the air blown on the thermometer was warmer than the air in which the thermometer was placed. On the contrary, I find it quite the reverse. Any one can try the experiment for himself. Place a thermometer in a close room, wait till the mercury has become settled in accordance with the temperature of the air in the room, then take a fan and fan the bulb of the thermometer briskly, when, in a few seconds, the mercury will begin to fall. I have seen it fall as much as four degrees; particularly if the temperature of the room was high.

I have often tried the experiment in the open air, and in different situations, and I find that, air blowing on the dry bulb of a thermometer, if the air is not hot, will cause the mercury to sink. W. T. L.

Cherrytree, Pa.

[We do not regard this experiment as at all satisfactory. The air of a room is always colder at the bottom than where a thermometer usually stands or hangs. It follows of course that disturbing or mixing the cold air with the warm, as would be done with a fan used in the way described, the temperature at the point where thermometers usually hang would fall. Let our correspondent place his thermometer close to the floor, then fan the bulb, and he will find the mercury will rise. But if he wishes to try an accurate experiment let him place his thermometer in a tube, and force air of uniform temperature over the bulb, the mercury will expand from the heat generated by the friction of the air on the bulb. We said, in the article referred to, that this expansion would be small, but the application of the thermopile and galvanometer will show there is a positive increase of heat from the friction of the air.—Eds.

Popular Errors Regarding the Watch—Setting the Hands.

Messrs. Editors:—How the popular idea obtained that turning the hands of a watch backward was injurious, is difficult to determine; probably from the fact that the minute hand of a striking clock cannot be turned back past the figure 12. The obstruction to the backward motion of the clock hand is occasioned by the interference of the lifting pin, whose office is to set off the striking part at the hour figure. Many French and English clocks are so constructed as to allow the hands to be reversed without injury to any part; but in all watches, even those that strike or repeat the hours, and in all clocks which have no striking part, the hands can be turned backward or forward at pleasure.

The hollow pinion to which the hand is attached, technically called cannon pinion, slips on to a smooth round arbor prolonged through the dial from the center-wheel. It is crowded on the arbor with just sufficient *closeness* (friction) to carry the hand when the clock or watch is going, but yet with sufficient *looseness* to allow it to be turned in either direction without detriment.

If there be any possible injurious effect, it is when the hand is turned *forward;* for then the force necessary to overcome the friction of the pinion on the arbor is added to the force of the main spring (or weight) on the train of wheel work; but in reversing the hands, the force necessary to turn the pinion is taken from (diminishes) the force of the main spring on the train.

The danger of injury to the movement of either clock or watch by setting the hands in either direction is when the cannon pinion is driven on too tight by the watch-maker, or becomes rusted on by the use of a key *into* which the owner has blown a little salivia in attempting to blow *out* a little dust previous to using it. Whenever the hands move unpleasantly hard, take the watch at once to an honest, skillful watch-maker, and in ten minutes he can remedy the difficulty. "A stitch in time," etc. R. Cowle.

Cleveland, O.

How to Cure Mold in Carpets.

Messrs. Editors:—A. B., of Pa., asks through the medium of the Scientific American how to remove the disagreeable musty smell from his Brussels carpet.

We removed the disagreeable smell from our Brussels carpet as follows: The carpet was a new one, the room was also new. After living on the floor for about six months, the smell became so disagreeable that we could scarcely remain in the room (the room was well ventilated and used every day).

We took the carpet and spread it on the grass, wrong side up, where the sun shone upon it all day; in the evening we gave it a good beating, and carried it to the house; the next morning we carried it to the lawn and spread it as before; in the evening we gave it another beating, and swept both sides with a stiff broom, and placed it back on the floor.

It is now perfectly sweet. The smell is caused by the damp weather affecting the starch in the goods. Damp weather will cause all kinds of heavy goods that have starch in them to smell badly, also felt hats, paper, etc.

Manchester, Ohio. C. C. Cooley.

Buzzing Up.

Messrs. Editors:—Some time since a communication appeared in your columns in regard to the process of "Buzzing Up," describing somewhat the nature of the experiment, and the method of performing it. While it would seem that the instructions given were sufficiently explicit, it still appears as if some important item were omitted, for recently a party, of which the writer of this was a member, made a long and faithful trial, without the least apparent success. While it did require some effort at first to comply with all the conditions, nevertheless, after a faithful and persevering effort, the party was obliged to abandon the attempt without the pleasure of having the subject "feel that the gravitation was out of him."

Cannot your correspondent give us more full instructions in regard to the method of performing this interesting experiment? L. U. Chapin.

A Dryer for Coal Tar.

Messrs. Editors:—I see in your paper of August 20th that D. C. L., of ——, wishes to learn of some cheap ingredient which added to coal tar will add to its drying properties on iron. You can inform him and the public generally that gasoline is the best and cheapest article, and will dry as soon as applied leaving a fine, glossy surface similar to varnish. I have used this with a great deal of satisfaction on iron; and it is also a good and durable paint for tin roofs, and most durable when applied in the heat of the day.

Helena, Ark. G. W. Holibaugh.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections for the month of July, 1870:

During the month, 575 visits of inspection have been made, and 1,092 boilers examined, 1,006 externally and 330 internally, while 97 have been tested by hydraulic pressure. Number of defects in all discovered, 549; number of dangerous defects, 59. These defects in detail are as follows:

Furnaces out of shape, 23; fractures, 50—10 dangerous; burned plates, 52—8 dangerous; blistered plates, 56—3 dangerous; cases of sediment and deposit, 54; cases of incrustation and scale, 80—5 dangerous; cases of external corrosion, 35—7 dangerous; cases of internal corrosion, 9—2 dangerous; cases of internal grooving, 2—1 dangerous; water gages out of order, 33—2 dangerous; blow-out apparatus out of order, 4; safety valves overloaded, 26—4 dangerous; pressure gages out of order, 80—5 dangerous; boilers without gages, 5; cases of deficiency of water, 3—3 dangerous; broken braces and stays, 18—6 dangerous; mud pipes and drums badly corroded and condemned, 1; boilers condemned as unsafe to use and beyond repair, 1.

Attention is called to 18 cases of broken braces and stays. True, it is a small number as compared with the whole number of boilers examined internally, but six of these were regarded in dangerous condition, and if one disaster has been prevented the importance of internal examinations is demonstrated. Stays become weakened by long use. When boilers are kept under high pressure day after day, the stay and braces have a heavy duty to perform, and they become "fatigued." We have had reported to us instances where the braces and stays "were as brittle as pipe stems." If there are such instances, or if the long use of boilers will cause this condition of things, it is all-important that they be internally examined at least once a year. A boiler, apparently well stayed, but actually in a weak condition, is little better than an infernal machine.

Some Characteristics of Modern Fire-arms.

As events thicken on the area of passing strife, many theories in respect to military fire-arms are tested by inexorable practice. Speculations as to the relative superiority or inferiority of fire-arms are narrowing themselves into the category of proven facts. At the commencement of this war both artillery and small arms had entered upon new phases, but it was in respect to military small arms chiefly that the greatest difference of opinion existed, or was assumed to exist.

Speaking for ourselves, we never were of opinion that any slight shade of difference in the purely mechanical superiority of the Chassepot over the needle gun, or the latter over the Chassepot, would count for so much as zealous advocates and partisans on either side expected. We have been in the habit of thinking little of the fact that the effective range of the French small arm is greater than that of the Prussians, or that the wounds inflicted by the Chassepot are more ragged and deadly in character. At any period before the breaking out of this war we should have been perfectly willing to concede that the Zündnadelgewehr is—taken all in all—a more imperfect mechanical instrument than the Chassepot, which latter, however, has many defective points. Conceding all this, there was no time at which we should have been averse to credit the Prussians by anticipation with much of the success as marksmen that they have since achieved; our reasons for this belief mainly hinging on the fact, too often forgotten, that, in a mechanical point of view an arm and its ammunition are not all in all. The physique and temperament of the shooter are items in the mechanical account—the soldier being to all practical intents an integral part of the machine.

This view has been amply borne out in all the contests which have occurred between the French and Prussians up to the time when these remarks are made. It has been proved that the French temperament, by its impetuosity, its mobility, its desire to be doing something, has proved itself very much at a disadvantage in all that concerns the successful management of a military breech-loading small arm. Even in the old days of muzzle-loading,the great difficulty in action was to supply cartridges with due rapidity, many instances having occurred in which soldiers have had to elect between injudicious bayonet charges or absolute retreat, merely because their ammunition had given out. This being the fact, it always seemed to us that two of the very advantages claimed by the French for the Chassepot over the needle-gun,namely, its longer range and its greater rapidity of delivering fire, might turn out absolute disadvantages in the field. So far as events have gone, and can be accurately taken count of, this has absolutely seemed to have been the case. At the battle of Forbach groups of French infantry were seen making their way in disorder to the rear, merely because their ammunition had been all fired away; and subsequently, at Wörth, MeMahon complained that his infantry had not been able to keep themselves supplied with ammunition in the contest.

Coming next to the mitrailleuse, it does seem wholly inexplicable, and not more inexplicable than ridiculous, that the French should have affected so much mystery in respect to a weapon that, whether good, bad, or indifferent, presents such obvious indications of constructive points to be carried out into practice, and which could have been executed in many different ways. The French Emperor, as most of us know, once wrote a folio book on artillery and fire-arms generally. His Majesty has ever since manifested a certain amateur predilection for this branch of the service; but it, as would appear from published accounts,he has had anything to do with placing the mitrailleuse in the rank of an artillery instead of an infantry weapon, then we think his inspirations have led him very much astray. In some respects an instrument on the principle of the mitrailleuse has important functions and capabilities—perhaps we should rather say it is a machine that makes important promises,but we should have imagined that some of the most obvious considerations of what modern field artillery is expected to do would have led mitrailleuse constructors to determine its place as an infantry weapon from the first. By infantry weapon we mean that, although necessitating a service of its own, the mitrailleuse, its genius and construction regarded,should emulate small arms rather than artillery if it would hope to give a good account of itself. In the present day field artillery is not worthy the name if it does not embrace, or has not the faculty of embracing, shell practice. Obviously no mitrailleuse, light enough to take part in field evolutions, could be endowed with that faculty to any but a limited extent. Weight and cumbrousness would be against it if made large enough for shell practice,and even were increased weight no longer a consideration, it would still be undesirable to project shell in such a salvo from such a machine. We English have, no doubt, placed the mitrailleuse in its true prospective rank. Recent experiments at Shoeburyness have proved that it can advance no pretensions to rank as an artillery weapon; that it is specially an infantry weapon; and, further, that to be effective the mitrailleuse should be able to employ the ordinary small-arm service cartridge, of whatever description that may be. Here we must observe that the ordinary compound cartridge of the British service—the Boxer cartridge—does not appear to answer well for mitrailleuse purposes.

Relative to the barrel contruction of the mitrailleuse, we have heard even mechanicians wonder why the expedient of aggregating thirty seven hexagonal barrels in a circumscribing case of wrought iron is resorted to, when, as seems to them, the much more simple expedient of boring thirty-seven barrels out of a block of steel is at hand. If a mechanician, clever as he may be, would only try his hand at making a mitrailleuse in such fashion, his eyes might, perhaps, be opened and his opinion might alter. Some years ago Sir Joseph Whitworth, relying on accurate machinery, thought he could make double-barreled fowling pieces by boring two holes out of an elongated steel block. He found himself mistaken, as anybody would find himself mistaken who should make a similar attempt.—*The Engineer.*

THE TRAINING OF PRUSSIAN AND FRENCH SOLDIERS.

BY ARCHIBALD MACLAREN, OF THE OXFORD GYMNASIUM.

The Prussian soldier's period of service is so short (three years) that every agent to hasten his efficiency must be seized; and it has been found necessary to provide means, in the shape of large buildings resembling riding-schools, in which drill may be carried on throughout the year. And as this gymnastic system is viewed but as drill, aims but in being drill, it is, in winter, carried on in these buildings; the few articles of apparatus employed, for the sake of the advantages which they specially offer to the soldier, being erected in a corner of them. And this continuity of practice increases manifold whatever good it can yield; and thus, meager and inadequate as it is, its fruits are valuable. It is found that no other form of drill so rapidly converts the recruit into the trained soldier, and the greatest importance is attached to its extension throughout the army.

There is a general impression that this system forms the basis of the French. It would be difficult to make a greater mistake; for not only have they, either in principle or practice, nothing in common, but in many respects they are the very antitheses of each other. So far from the boasted "simplicity" of the Prussian system, and the desire to limit it to "a few exercises to be executed with great precision," being adopted by the French, they have elaborated their system to such an extent that it is difficult to say where it begins or where it ends, or to tell what it does, but what it does not embrace. For quite apart, and in addition to an extended range of exercises with and without apparatus, it embraces all defensive exercises, with bayonet and sword, stick, foil, fist, and foot, swimming, dancing, and singing, reading, writing, and arithmetic, if not the use of the globes. The soldier is taught to throw bullets and bars of iron; he is taught to walk on stilts and on pegs of wood driven into the ground; he is taught to push, to pull, and to wrestle; and although the boxing which he is taught will never enable him to hit an adversary, he is taught manfully to hit himself, first on the right breast, then on the left, and then on both together, with both hands at once; and last, but not least, he is taught to kick himself behind, of which performance I have seen Monsieur as proud as if he were ignominiously expelling an invader from the *sol sacré* of La Belle France. Now I know no particular reason why a soldier should not be taught all these acquirements; and I know many important reasons why he should be taught some of them; but it would be difficult to assign any reason, either important or particular, why they should be called gymnastics, or be included in a system of bodily training.

The fundamental idea of the French system is sound, for it embodies that of preparation and application; it is primarily divided into two parts—*Exercices Elémentaires and Exercices d'application.* The first of these, designed to be a preparation and prelude to the instruction and practice on the fixed apparatus, begin with a long series of exercises of movement and position, *propres à l'assouplissement.* What is this all-important process of *assouplissement*—this idea, shared at home as well as abroad, by civilian as well as soldier, of the necessity of suppling a man before strengthening him? What is it to supple a man? What parts of him are affected by the process and what change do they undergo? It would be very desirable to have these questions answered, because want of suppleness is a common subject of complaint, and though often caused by apparently different processes has really but one origin.

To ascertain the full meaning of a word or phrase, it is sometimes useful first to ascertain its opposite or antithesis; and the opposite of to be *supple* is, I think, to be *stiff.* If any one is in doubt as to what that means, let him take a day's ride on a hired hack along a country road, or, for the space of a working day, perch himself upon an office stool, and the results will be identical and indubitable—stiffness in the column of the body and in the lower limbs. And why? Because each and every part so affected has been employed in a manner out of accordance with its natural laws. The joints, which are made for motion, which retain their power of motion only by frequent motion, have been held motionless. The muscles, which move the joints by the contraction and relaxation of their fibers, have been subjected to an unvaried preservation of the one state or the other—the muscles of the trunk in unremitting contraction, those of the limbs in effortless relaxation. Now, one of the most important of the laws which govern muscular action is, that it shall be exerted but for a limited continuous space, and that, unless the relaxation of the muscles shortly follows upon their contraction, fatigue will arise as readily, and to as great an extent, from want of this necessary interruption to contraction as from extent of effort. And, strictly speaking, this stiffness, both in trunk and limbs, although arising from two opposite states of muscular employment, results from the same cause, *i.e.*, exhaustion; each has had one only of the two essential conditions of muscular action, that one being therefore in excess. The stiffness in the trunk of the body is caused by the ceaseless contraction of the muscles, and this state is not conducive to the rapid local circulation indispensable to the reproduction of the force expended. The opposite phase of stiffness, arising from continuous muscular relaxation, is the immediate result of causes which may be called negative—the non-requirement of nervous stimulus, the non-employment of muscular effort, entailing subdued local circulation.

The second cause of this stiffness in the trunk of the body and limbs is, that the joints have been held motionless. Viewing the joints in the familiar light of hinges, we know that when these are left unused and unoiled for any length of time, they grate, and crack, and move stiffly; and the hinges of the human body do just the same thing, and from the same cause; and they not only require frequent oiling to enable them to move easily; but they *are* foiled every time they are put in motion, and when they are put in motion only; the membrane which secretes this oil, and pours it forth over the opposing surfaces of the bones and the overlying ligaments, is stimulated to activity only by the motion of the joint itself.

But, it may be argued, stiffness may arise from extreme physical exertion, which has embraced both conditions of muscular action, with frequent motion of the joints, stiffness such as a man may experience after a day of unwonted exercise. The stiffness in this case, also, is simply temporary local exhaustion of power from extreme effort; the demand suddenly made has been greater than the power to supply—the waste greater than the renewal.

Stiffness, therefore, appears to be, first, a want of contractile power in the muscles which move the joints; and, secondly, a want of power in the joints to be moved. It may be temporary stiffness, arising from exhaustion of the parts by extreme or unnatural action, as in the illustrations just given; or it may be permanent stiffness, arising from weakness of the parts, caused by insufficient or unsuitable exercise; but the nature of both is identical. It is lack of functional ability in the parts affected.

To supple a man therefore is, first, to increase the contractile power of his muscles; and secondly, to increase the mobility of his joints. And as the latter are moved by the former—can only be moved by the former—all application for this purpose is made through them.

Now, even although mere movements and positions were altogether adequate materially to develop the muscular system—materially to add to its contractile power, there is a still greater drawback than mere insufficiency in their effect upon the joints; and that is, in the danger of straining, and otherwise weakening the inelastic ligamentary bindings. For every effort of mere position has the simple and sole effect of stretching that which, from its organic structure, object, and place in the human body, is not stretchable—is not intended to yield.

To recapitulate: All exercises of mere position act directly on the joints, instead of acting on them through the muscles. Such exercise is, therefore, addressed to the wrong part of the body; it is addressed to the joint, when it should be addressed to that which moves the joint. It is the old and exploded treatment of an abnormal physical condition—subduing the symptoms instead of waging war with the cause.

The other exercises in this first division of the French system—even if they were valuable, even if they were capable of being classified under any distinct head, or arranged in any progressive order, or admitted of graduated instruction and practice—are entirely out of place here, because from their nature they court and incite to inordinate effort. It needs no argument to prove the inconsistency of directing that men, sitting or standing, hand to hand, or foot to foot, singly or in batches, shall strain and strive against men, lift cannon-shot and hold them out at arm's length "as long as possible," or sling them to their feet to cast them to a distance "as far as possible," before they are allowed to put hand or foot on an ordinary ladder inclined against a wall, or to walk along a plank raised a foot or two from the ground. It needs no argument to show that this is reversing the order of exercise when measured by the amount of effort required for its performance.

The second division of the system, consisting of applied or practical exercises (*Exercices d'Application*), embraces a very extended series, to be executed on a wide range of apparatus; and it may be broadly stated that all these exercises are valuable in either an elementary or a practical aspect—that is, either as they are calculated to cultivate the physical resources of the man, or as they may be applied to the professional duties of the soldier. I repeat, that the exercises of this division of the system are intrinsically valuable in one or other of these aspects; but it must ever be viewed as a grave error, that, so far from the special aspect of each being designated, so far from their being separated and grouped, each under its proper head, they are all retained under one head, under the single designation of "Practical Gymnastics."

The evil which naturally and inevitably springs from this want of arrangement, is the undue importance which it gives to all exercises of a merely practically useful character above those whose object is the training and strengthening of the body. This is emphatically the case in the earlier stages of the practice, where the whole attention of the instructor should be devoted to the giving, and the whole effort of the learner should be devoted to the acquiring of bodily power. Increase the physical resources first, and the useful application will follow as a master of course. A pair of strong limbs will walk north as well as south, up hill as well as down dale—the point is to get the strong limbs.

Let not this principle of classification be undervalued. The question of "What's the good of it when I've done it?" is one not unheard in the gymnasium, and one not always easy to answer; and even could you be at all times ready with a physiological explanation of motive, process, and result, your questioner is not always a man who could understand it, and the difficulty is increased manifold when the exercise questioned has place among others of the practical value of which there can be no question. But such classification gives at once the answer: "It is of no use at all as a thing acquired; but if you should never do it or see it done again in all your life to come, it has served its purpose; for *you* are altered, *you* are improved, *you* are strengthened, by the act and effort of learning it."

But men, so intelligent as those who are intrusted with the administration of the French system, have perceived the propriety of a special application of the exercises practiced at the close of the course of instruction. And, therefore, to the *bonâ fide* exercises of the system are added certain practices in which the men are employed in "storming works, and in undergoing an examination of their general proficiency."—*Herald of Health.*

CANADIAN INVENTORS IN THE UNITED STATES.—We, says the *Canadian Pharmaceutical Journal*, notice that under the recently amended Patent Law of the United States, Canadian inventors, in common with other foreigners, are allowed to apply for patents on the same terms as citizens of the United States. The SCIENTIFIC AMERICAN thinks the example worthy to be followed by the Government of the Dominion. We heartily agree with our cotemporary, and hope that our law givers will fall in with reciprocity—at least as far as genius is concerned.

IN 1866, Prussia conquered Austria in six weeks. It is almost incredible that she should have repeated the same thing on France in 1870—the latter supposed to be the strongest military power in Europe.

THE production of Lake Superior copper ore this year is estimated at one million tuns, which is twice as much as was produced in the entire United States in 1843.

L. I. Trueg's Heliorama.

The instrument herewith illustrated has been appropriately styled the "*Heliorama*." We shall confine our description to giving, as well as we may, the scope and uses of the instrument without going into the minute details of its construction, or discussing at length the rationale of its operation. The latter will be sufficiently apparent to those familiar with astronomy and the construction of astronomical instruments; while to those unfamiliar with the science it would be hardly possible to give, in the limited space to which we are confined, a complete exposition of the principles upon which the instrument is based.

Its name signifies the spectacle of the sun, the application of which to this instrument implies that by its use the apparent relations of the positions of the sun and earth to each other may be determined, and the latitude of any given point upon the earth, and its true time by sun, or its true time by clock, may be deduced from these relations.

It may be considered as compounded of two distinct instruments, one called the "*Helioclasis*," by which latitude is determined, and the "*Hemerophora*," by which the time is determined.

It is well known that the instruments hitherto used for the determination of latitude from solar observations by seamen and astronomers can only be used to advantage at mid-day. Observations made before or after this time only approximate the true latitude. The helioclasis does this however at any time the sun is visible between the hours of 6 o'clock in the morning and 6 o'clock in the evening; a very slight adjustment only being necessary, so that, given one minute of sunshine between these hours, the mariner may determine the latitude with precision.

A basement bed, A, Fig. 1, carries two side pieces, B, which support a revolving plate, C, on which two arcs, the one a semicircular brass plate, D, called the "*Equatorial Gnomon*," the other, E, an arc of fifty degrees called the "*Cliseologet*," are so adjusted that the center of each touches the periphery of the other from within, their radii being equal. The equatorial gnomon stands perpendicular on the plate, its diameter touching the surface of it, and bisecting the cliseologet at right angles. The point of bisection is degree 0, from which, on both sides, degrees are counted up to 25. The plate bears a list of the declination of the sun for every tenth day throughout the whole year. When the instrument is set up the basement bed must be level, and the front directed towards the south, which purpose the compass, F, in the basement is intended to serve; then the list on the plate must be consulted. If we have, for instance, April 1st, the list tells us that on that day the sun's declination is four and four tenths degrees, the plate must be then turned until the shadow of the sun, cast by the gnomon, falls on that degree. Look at the degree of latitude marked on the side pieces, facing the west. A hand attached to the pivot of the plate, B, and moving with it, indicates that degree of latitude on which the place of observation is actually situated. At sea, the instrument will be most serviceable if kept in its proper direction (with regard to north and south) by a large magnet.

In order to make the correction for refraction, the graduation on the arc, on the side piece, C, is so made that in the distribution of degrees, thirty-three minutes of arc are lost, so that on the place where 89° 27′ would come, 90° would appear. The refraction of the sun's rays corresponds to this marking, as it is at twenty degrees, twenty-one seconds; at thirty degrees, thirty-three seconds; and at ninety degrees, thirty-three minutes.

Another correction for the radius of the sun's disk, 16′ may be made, if deemed necessary, by subtracting that number of minutes in the graduation of the arc, on C, so that ninety degrees are marked at a real distance from 0° of 89° 11′.

The second instrument of the heliorama is the hemerophora, which is an improved sun-dial. It shows not only the correct sun time but also the mean time—that is, the time which a correct clock shows.

In construction (Fig. 2) it is an inverted helioclisis, for that arc which there casts the shadow is here inverted in order to receive it, while that arc which there receives the shadow, being inverted, is here made to cast the shadow. The deviation of the sun time from the clock time, is corrected by an apparatus which moves the arc that receives the shadow, called *Horologet*, and sets it so as to show the time of a correct clock. A movable hand, G, points to the different dates of the year. No sun-dial until this has been able to show the exact sun time at every hour of the day, and at any season of the year. At any moment, when the sun shines, the hemerophora or heliorama shows what former sun-dials could only accomplish with accuracy at one moment of the day, and it indicates the mean time besides the sun time.

The arc, H, which is called the "*Horologet*," is divided regarding the hours as follows: From 6 o'clock A.M. to 6 o'clock P.M. is 180°. The intervening space is divided into 15° divisions for hours, and these divisions are subdivided into quarters. The horologet, H, is more than a semicircle, so as to gain space for the inscription of at least one hour more for the morning and one more for the evening, in order to mark time for longer than twelve hours in the summer season. This arc may moreover be shifted about its center by moving the pointer, G, so as to adjust the horologet to the time of a correct clock.

The arcs, I K, over which the pointer, G, moves, have marked thereon days of the year, to which if the pointer be placed, the horologet, H, will be shifted to correspond with the time of a correct clock for that day to which the pointer is moved.

L is the gnomon, placed permanently at right angles with the horologet, as shown, and made to give correction for refraction by making the radius of its arc one thirty-second greater than that of the horologet. The effect of this is to cast the shadow backward at morning, and forward at evening, so that the shadow shall fall on the 6 o'clock mark on the horologet at precisely when the sun rises and sets at the equinoxes.

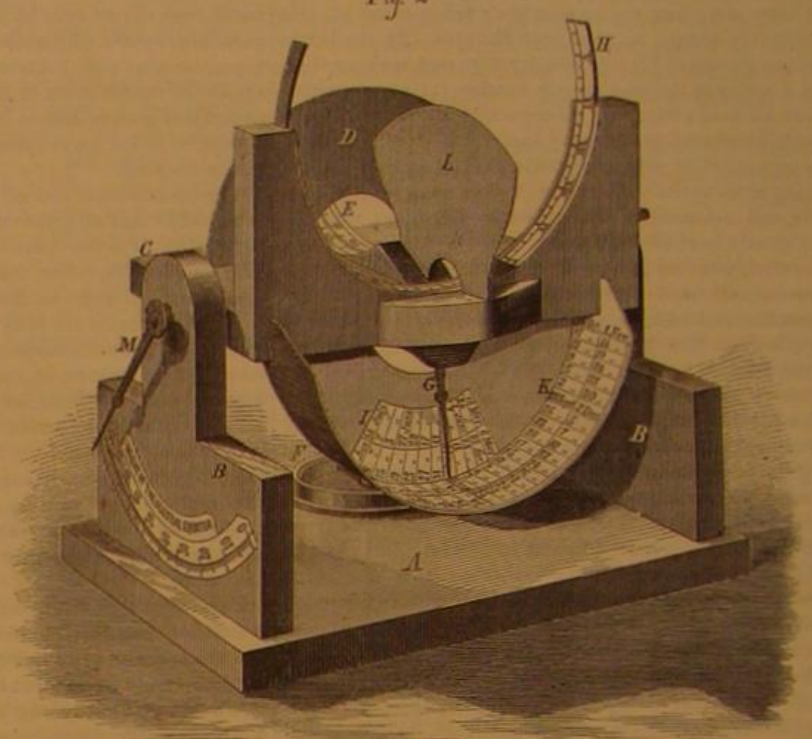
On the side piece, C, Fig. 2, is an arc which shows by the pointer, M, the hight of the celestial equator at the same time that the opposite hand or pointer, Fig. 1, shows the latitude.

It will be observed that the construction of this instrument is very simple, and those familiar with the instruments heretofore used to effect the same purposes, will understand its adaptation to the ends proposed.

The inventor wishes to dispose of a part or the whole of his patent, which was patented, through the Scientific American Patent Agency, December 28, 1869, and March 8, 1870 Address Ludwig Ignatius Trueg, St. Vincents, Westmoreland county, Pa., or publishers of the "Patent Star," 119 Milk street, Boston, Mass.

Fig. 1

Fig. 2



TRUEG'S HELIORAMA.

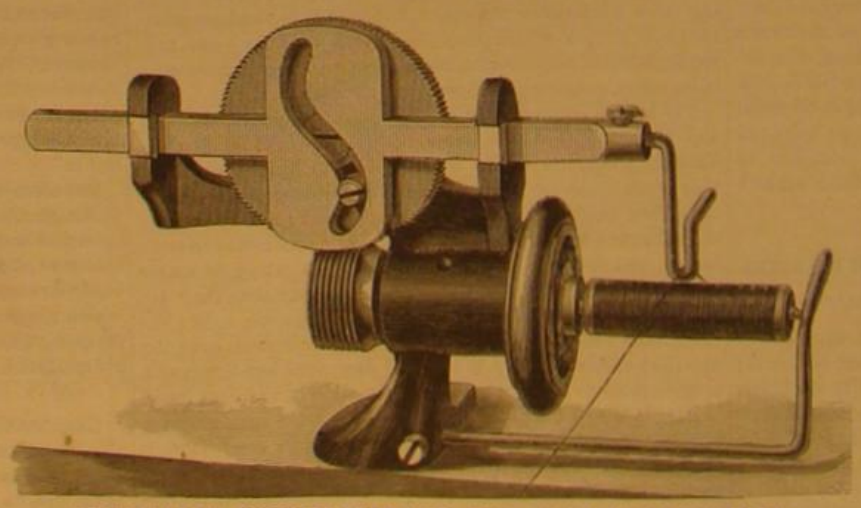
A Mystery in Lawrence, Mass.

A correspondent from Lawrence, Mass., sends us an account of a singular thing which is exciting the curiosity and the superstition of the good people of that thriving town. It is no less than the image of the head and a portion of a female figure lately discovered upon two adjoining panes of glass in the window of a house, and supposed by some to be the portrait of a lady who recently died in the same building We regard the whole affair to be another hoax intended ultimately to put money in somebody's pocket. There is no doubt of the existence of the image, and the question is, How was it formed? Similar questions were put in reference to the Cardiff giant, which were satisfactorily answered in time as this perhaps will be.

Automatic Bobbin Winder for Sewing Machines.

One of the chief arguments used by the chain-stitch sewing machine interest against the double-thread machines is the trouble experienced in winding bobbins. The chain-stitch machines using thread direct from the spool do not involve this difficulty. It is the object of the invention we herewith illustrate to provide an automatic bobbin winder that shall fill the bobbins while the machine is in operation, so that all the operator has to do when a new bobbin is required is to place it in the shuttle. Each bobbin is similar to all the others when filled and the apparatus may be so adjusted that long or short bobbins may be wound with equal facility and certainty.

The simplicity of this ingenious addition to the sewing machine is such that it will be at once understood, on reference to the engraving.



AUTOMATIC BOBBIN WINDER FOR SEWING MACHINES.

The stock of the bobbin winder is screwed to the clothplate of the machine. The bobbin is placed upon a spindle, the shaft of which has upon it a small grooved pulley which rests against, and is driven by the band from the fly wheel. A worm on this spindle works in a toothed wheel. This wheel has projecting from its side a pin which works in a cam attached to the thread guide. This arrangement gives a traverse motion to the thread guide from end to end of the bobbin as the spindle revolves, thus distributing the thread evenly along its surface, and filling it much more uniformly than can be done by hand.

The cam slot is S-shaped, and the pin working therein is adjustable to and from the center of the toothed wheel, by which the traverse motion is shortened or lengthened to wind bobbins of different lengths.

These bobbin winders are made in different styles for the various shuttle machines in use, and appear to us very desirable and useful additions to such machines.

Patented, through the Scientific American Patent Agency, April 19, 1870, by Thomas Shanks, cor. Lombard and Sharp streets, Baltimore, Md., who will negotiate with manufacturers desiring to manufacture on royalty, and who may be addressed for State rights or the entire right.

Words are the tools with which the mind works.

Scientific American,

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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 the country.

THE INCREASING USE OF GLYCERIN.

A few years ago all the glycerin that was casually made in the soap, candle, and lard industry was thrown away. At the present time it is carefully saved, and its applications have been so much extended that it has become a prime article of manufacture, and one that could not easily be dispensed with. Some of the uses are not popularly known, and it may be well to recapitulate them for the benefit of our readers.

The presence of glycerin in fermented liquors was proved by Pasteur ten years ago, and on this discovery was founded an artificial manufacture of wine which has since become a regular business. We have occasionally published paragraphs on the use of glycerin in sweetening wine, and have reason to suspect that much of the champagne of commerce owes its peculiar flavor to the presence of this foreign liquid. As it is not particularly deleterious to the system its use is a decided improvement on the custom of adding sugar of lead to wines and champagne practiced in ancient times. After the discovery of glycerin in wine, attention was turned to other liquors, and it was found to exist in the best German beer in minute quantities as the result of a natural fermentation. This fact showed that in the fermentation of wort, besides the transformation of sugar into alcohol and carbonic acid, a secondary modification took place called succinic fermentation, that is, the change of a part of the glucose into succinic acid and glycerin. We have never heard of the employment of succinic acid to improve the taste of beer, and are not likely to be troubled in this way on account of the great cost of the material; but the use of glycerin by brewers has now become an every-day fact in Europe, and it is said to add to the keeping qualities as well as to the taste of beer. The quantity taken is small, amounting to from one half to one measure of glycerin to 100 measures of wort. A pound of glycerin costs at wholesale in Germany twenty cents, and it is said to go as far as two pounds of extract of malt. It is probable that for home-made beer and domestic brews of all kinds glycerin could be advantageously employed if the proportions could be popularly explained.

Another property of glycerin upon which many uses are now founded is the facility with which it dissolves a large class of bodies, and at the same time preserves them from alteration or decay. It dissolves aniline violet better than alcohol or acetic acid, and could be employed in dyeing with this color.

Gum-arabic is soluble in glycerin, and the solution does not readily turn sour or become covered with mold. A somewhat similar action is shown towards albumen which it readily dissolves and keeps from decomposition. In both of these cases the solutions are useful in photography.

Another application in photography is to add a small quantity of glycerin to collodion to prevent too rapid drying. Such collodion is less sensitive, but admits of a longer exposure than the ordinary wet collodion, and is valuable in taking landscape pictures.

An addition of glycerin to paper in the manufacture of wall paper adds to the absorbing property of the surface, and prevents the spreading of the colored patterns, without interfering with the drying qualities of the pigments. When mixed with litharge to a paste, glycerin forms an excellent cement for iron and stone, which becomes very hard and resists the action of most agents.

The much prized madder colors, alizaine and garancine, are soluble in glycerin and can be applied cold. The addition of water does not precipitate the colors, and boiling with alum and cream of tartar fixes them to woolen goods. The glycerin appears to extract the colors, and it is probable that in the case of wood and other dyes it is capable of a similar application.

In the manufacture of paper, when it is desirable to impart greater softness and elasticity, the glycerin can be mixed with the stock in the mill in the proportion of ten pounds of glycerin to two hundred pounds of stock. For copying and taking impressions the paper can also be immersed in a bath of seven parts glue to one part of glycerin.

Perhaps one of the most important applications of glycerin is in the preservation of meat from decay. For this purpose the sweet liquid ought to be thoroughly purified, so as not to impart any flavor to the flesh. As the pure glycerin requires a lower temperature to freeze it than mercury, the vessels containing the meat can be kept in very cold places. The same property of glycerin has been taken advantage of in collections of objects of natural history which are now immersed in it instead of in alcohol. The same preservative property is employed to keep medicines and many chemical compounds from premature dissolution.

Sculptors have found considerable difficulty in keeping their modeling clay moist, and to attain this object must generally have recourse to water. The admixture of glycerin has been found to be of great assistance, as it does not readily evaporate and holds the moisture a long time.

There are some articles of food that require to be kept in moist condition, and this could be accomplished by the use of a small quantity of glycerin. It is also probable that bread could be kept from drying up or molding in the same way. It has long been customary to mix molasses, sugar, and extracts of roots with tobacco, and also to wrap up the packages in tin foil to keep the tobacco moist. Glycerin would serve a better purpose than any of the old substances without imparting any bad flavor to the tobacco.

The wet gas meter is a perpetual source of trouble in the winter on account of the freezing of the water. This is remedied by mixing glycerin with the water, and thus reducing its freezing point to near zero.

As a lubricator for delicate instruments, such as watches, clocks, chronometers, etc., especially if they are likely to be exposed to sudden changes of temperature, there is nothing so good as glycerin. The best oils oxidize and become thick and require constant watching.

In the manufacture of copying ink glycerin has for some time been employed as a substitute for sugar and sirups; it also keeps the ink from molding and decomposition.

A remarkable discovery was recently made that under certain circumstances glycerin could be fermented into alcohol. As the experiment was originally performed chalk and cheese (casein) were mixed with the glycerin at a temperature of 86° to 104° Fah., and left to react upon each other. It would be difficult to explain the reaction that took place, but there was no doubt about the formation of alcohol. A feasible way for making alcohol out of the sweet principle of oil would be an important discovery, and the further investigation of the subject is worthy the attention of chemists.

Mousseline weavers were for a long time compelled to carry on their work in damp cellars and unhealthy, ill-ventilated apartments; this evil is now overcome by the employment of a wash prepared out of dextrine, glycerin, sulphate of alumina, and water, and the workmen can drive their trade in the upper rooms of the house. The use of glycerin in the manufacture of a blasting oil is too well known to require anything more than a passing notice. Nitro-glycerin has become such an important article that to obtain it special works for the manufacture of glycerin would be constructed rather than to dispense with its use.

The difficulty of observing the compass on board of screw steamers is increased by the agitation constantly produced by the machinery, and this has been obviated to a considerable extent by the employment of compasses swimming in a liquid prepared of glycerin and water. A capsule of crystal glass is substituted for the old copper basin, and in this way, as the liquid is transparent, observations can be made at night.

It has been found that leather bands for machinery are much less likely to crack and break if they are soaked for a short time in glycerin after leaving the tanning vats.

Where quicksilver is employed in the manometers of steam engines it is liable to oxidize and clog the tube. This evil is remedied by putting in a few drops of glycerin on the top of the column of mercury and thus preventing the contact of the steam and moisture with the metal. Glycerin is now employed as a substitute for oil and fat in extracting delicate perfumes from leaves and flowers, and in the preparation of perfumery and cosmetics as well as for hair oils.

Glycerin soap is an article that within a few years has been introduced into market in a liquid and solid form. The liquid soap is prepared by heating 100 parts oleic acid, and 314 parts by weight of glycerin (sp. gr. 1·12) to 106° Fah., and adding 56 parts concentrated potash lye (sp. gr. 1·34) under constant stirring. This is an admirable soap for chapped hands and for cutaneous diseases and flesh wounds. The cost of the materials must prevent a large consumption of this article.

The addition of glycerin to glue has been highly recommended to prevent brittleness, and where gelatin is employed in the manufacture of artificial ivory, parchment paper, book-binders' stock, and the like. A paste composed of starch, glycerin, and gypsum retains its plasticity and adhesiveness, and can be recommended for luting chemical apparatus and in making plasters for pharmaceutical purposes India-rubber for removing pencil marks is improved by the addition of glycerin-glue.

Wood impregnated or washed with glycerin does not warp and dry up, and advantage is taken of this fact to keep butter tubs, water pails, barrels, and tanks from shrinking and leaking. Wood work exposed to the sun or heat of summer can be greatly benefited by occasional coats of glycerin. Molds in which plaster casts are taken are now moistened with glycerin. A mixture of glycerin and a few drops of ammonia is used as a valuable remedy in the case of bites of venomous insects, and in medicine generally the employment of glycerin has become very extensive.

We have thus enumerated the chief applications of glycerin, enough to show that it has become one of our most valuable articles of manufacture. We are not in possession of the exact statistics, but from the rate of consumption it is easy to infer that the amount annually made must be very large, and it is probable as its properties become more generally known that the demand for it will go on increasing to meet the new applications that will be discovered for it. There are few articles of chemical manufacture of more value than glycerin.

THE GOVERNMENT STORM SIGNALS.

Some two or more years since we urged the importance of the establishment of a series of storm signals to warn people at a distance of the approach of storms; the information to be conveyed by telegraph to prominent points, and distributed to the surrounding country by means of artillery discharges, striking of church bells, or other means not difficult to devise.

We do not claim to have originated this idea, and have now forgotten who made the suggestion. We saw, however, that it was a good one, and accordingly advocated it.

Our readers have probably most of them been apprised through the dailies that the Government is about to establish a storm signal service.

The corps of observers will be composed of non-commissioned officers in the army, under the direction of the chief of the signal corps, and its duty will be the observation and reporting of storms by telegraph and signals, to prevent loss to commerce upon the great lakes and the seaboard.

So far as this goes it is well, but we hope to see the system extended so as to take in the agricultural districts, at least through the season of harvest. Great loss is often sustained through damage to crops which the farmer is forced to leave out through long storms of rain when, if duly informed of the approach of such storms, he might easily provide against them.

This system of observation will, however, subserve other important ends besides the saving of life and property on the sea and lakes, and the protection of crops. It will give immense aid in the solution of many important meteorological problems of the highest interest. If the system should be sufficiently extended, the observations may throw great light upon the extent, rate of progress, change of intensity during the progress of storms, and many other interesting matters connected with the theory of storm generation and subsidence.

A similar system has been employed in Europe with great success in warning mariners of danger. In England, especially, it is said these warnings are now so systematically distributed that a very marked decrease of damage has resulted to the marine interests.

Thus the electric telegraph adds to the benefits it has already conferred upon mankind, by giving him notice of approaching dangers in the elements, and enabling him to prepare in good time to avoid them.

The fact that the great storms which nearly always come from some point in the west, in this zone, originate in the great plain lying east of the Rocky Mountains has already been quite definitely settled by meteorologists. Traveling at the most rapid rate yet observed they would be two or more days in reaching the Atlantic coast, while the wires can send the information almost instantly. It needs no argument to convince all intelligent minds that this storm-signal service may be one of the most useful established by the Government, provided the appointments be judiciously made, and the duties of the observers be conscientiously executed

MECHANICAL DRAWING.

We have lately had quite a number of inquiries from young mechanics relative to mechanical drawing, asking whether it can be learned from books without a living teacher, and if so what books are to be recommended.

In the first place we will say in answer to such inquiries that drawing requires considerable practice on the part of any who would excel in rapidity and delicacy of execution. To those who are willing to give time to it mechanical drawing offers no serious difficulties. Its principles are easily understood and applied from books without a living teacher, and many a young man, the writer among the number, has succeeded in this way sufficiently to execute creditably any work of this kind ordinarily met with in machine shops.

The best text-books are "Appleton's Cyclopedia of Drawing" and Johnson's "Practical Draftsman's Book of Industrial Design." These works, of which the latter is the most complete, are, however, expensive, and may seem beyond the reach of many young mechanics. Those, however, who cannot save out of the money they spend for unnecessary things and amusements enough to buy such a work, would hardly be benefited by it if they had it.

The necessary instruments and materials will also cost something. These ought to be good ones, as in mechanical drawing no fine work can be done with poor tools. It will cost for a good outfit, including instruments, about fifty dollars. The whole of this money, however, need not be at once expended. For some months all the instruments and materials needed will be a dividers, a protractor, pen and pencil compasses, one of medium size and one small, a bow pen, some pencils, a T-square triangle, ruler drawing board, a triangular boxwood scale, a cake of fine india-ink and a saucer in which to prepare it, and some sheets of buff drawing paper, such as is commonly used in shops for working drawings.

It is best to buy these instruments singly and add to the kit when others are needed. Many of the instruments put up in fancy cases and sold at the bookstores are such as no expert draftsman would tolerate. If possible in the selection of these instruments the advice of an expert should be obtained, but if this is not practicable the treatises above named give directions which, read carefully, will not permit the purchaser to go far astray.

Our young would-be draftsmen are thus confronted with two sacrifices, one of time, and the other of money, but these sacrifices must be made if they would make such progress as is possible to any young man of ordinary intelligence and rather more than the ordinary share of perseverance. If they will make these sacrifices, however, they may rest fully assured that the superior skill they will acquire in the actual performance of work at the planer, lathe, bench, or vise, the increased chance of advancement to places of responsibility, the increased knowledge attained in all departments of mechanical engineering, the high satisfaction derived from the power of expressing one's ideas in this way on paper, and the greater facility with which mechanical problems, either in new or old fields, can be worked out, will repay them a hundred fold for all the time and money expended.

We would be glad to recommend cheaper books than the ones we have named, but we know of none cheaper that will meet the requirements of the draftsman as a book of reference, or which give a sufficient variety of exercises and directions to guide the student to high excellence in this delightful art.

FEMALE INVENTIVE TALENT.

The question of what women can do and what they cannot do well, is one which has been much debated of late, and it is safe to say that facts and arguments laid before the public in the course of the discussion have done much to shake the belief, once so universal, that women are adapted to do nothing well but the domestic duties of the household.

The characteristics of women in their most perfect, and, to men, most attractive development, tend more and more from the rude, coarse types of women as found in savage life, and in the lowest class of civilized races. Among these characteristics gentleness, both in disposition and manner, is a thing indispensable to a refined masculine taste. Any occupation which is likely to decrease this feminine quality, will be repugnant to men in general.

One shrinks in disgust at the idea of female soldiers and coal heavers, and the average American farmer feels indisposed to see his wife and daughters at work in the harvest field, as was common in days of yore. We do not like to think of women in connection with dirt and the sweat of physical toil, and the desire if not the tendency of modern civilization has been to remove women as far as possible from all that is coarse, from all that gives hard, stern outlines to body or mind, and to cultivate in her a delicacy of form and feeling corresponding to the masculine ideal. It is true that the cultivation of delicacy in woman has been so injudiciously directed as in many cases to engender debility and disease. A certain amount of physical labor is as necessary to the health of women as of men; and the neglect of proper exercise, and errors in diet and dress, are chargeable with having weakened the physical constitution of women to a degree far beyond the limits of that refinement which men demand in the ideal woman.

Men also shrink from seeing women in positions and occupations which in their nature call for the exercise of courage, intrepidity, the faculty of combativeness, or the exercise of keen satire, as at the bar or in the forum. Such occupations call into active play a great variety of qualities, which are summed up in the meaning of the slang word "cheek," and which engrave lines of character on the faces of women, and develop peculiarities of mind and manner, which are little admired by most men.

But there is a great variety of occupations which women have begun to claim as fields for individual effort from which no intelligent, refined man, who views things as they really are, would seek to exclude them. These occupations in no way injuriously affect the qualities admired by the other sex They may and ought to be made as remunerative to women as to men now engaged in them; and their effect upon men is to cultivate effeminacy rather than that superb masculinity, which should be the pride of man as it is the admiration of woman.

Then there is a middle ground on which they both may meet, and work with equal benefit, so far as the cultivation of those qualities which each admire in the other is concerned. This middle ground comprises all the finer creative or imitative arts which call into play the faculties of constructiveness and ideality, and give scope to the imagination. Among the creative arts must be classed mechanical invention; and it may not prove uninteresting, as bearing upon the question of woman's natural capacity, to give the results of our experience of woman as an inventor.

In our practice as patent solicitors we have frequently been called upon to prepare applications for female inventors, and to correspond with them in relation to various inventions; and we can say to those who are unbelievers in regard to the power of women to achieve, as a class, anything higher than a pound-cake or a piece of embroidery, that the inventions made by women, and for which they solicit patents through our agency, are generally found to be in their practical character, and in their adaptation and selection of means to effect a definite purpose, fully equal to the same number of inventions selected at random from among those made by men.

Only last week we illustrated an improvement in sewing machine needles, and the method of securing them in the needle arm, invented by a woman, which certainly would not do discredit to the most experienced and ingenious male inventor.

This is no isolated case. Every now and then a woman comes into our office and modestly prefers her claims, evidently shrinking from the idea that she will be thought stepping out of her sphere, but, believing fully in the merits of her invention, desiring to secure some pecuniary benefit by patenting it.

Our experience teaches us that women have as much natural inventive talent as men, and that the circumstances under which most of them pass their lives only prevent an equal manifestation of this talent on their part.

AMERICAN MAGAZINE LITERATURE.

The list of American Magazines is constantly increasing and this kind of literature has become an immense force in molding public opinion and morals. The demand for it increases with every month, and, though many periodicals are born to a brief existence, there are quite a number which give evidence of permanent vitality. Among these are some which have already been established for years, yet which are fully rivaled both in merits and defects by far younger competitors.

Without pausing to discuss the peculiarities of each, it may not be amiss to consider briefly such characteristics as are common to most of them, and to inquire what is likely to be their influence upon the minds, morals, and tastes of their readers in the future.

A most prominent feature of American magazines as a class, is the prominence given to fiction. We do not object to fiction, provided it is good of its kind. In the hands of its masters it has done and is still doing much good. It may be made the vehicle of instruction. It may cultivate taste and the finer emotions of the human heart, which in this utilitarian, practical age need a good deal of cultivation to keep us from degenerating into cold and selfish disregard of the miseries and troubles of others. It may teach us human nature, and open our eyes to the follies and inconsistencies of our social system. It may bring our minds and hearts into immediate contact with the pure and the beautiful, teaching us to love all that is true and lovely, and stimulating in us a wholesome disgust for all that is coarse, vicious, unlovely, and degrading.

In the hands of its masters, fiction does all this, but, unfortunately, all are not masters of fiction who write the stories for our magazines. We much doubt whether such short stories as those which make up the main stock of fiction mostly relied upon by publishers, could be made, even in the hands of masters, to reach the true end for which all fiction should be written and read. At best, they can serve only the same purpose as the imperfect sketches of the painter, useful, perhaps, as minor studies, and so useful only when produced by a master hand.

One looks, however, vainly to gather many such gems from the American novelettes of the period. Most of them deal in sickly sentiment, painting it in false, and, at times, even prurient colors. Even the attempt to delineate the higher phases of human thought and feeling often ends in what, to the critical observer, must appear as a miserable caricature of true nobility in mind and heart. As for instruction in anything that the readers of such stories need to be taught, they are lamentably deficient. We can, therefore—judging of American magazine fiction as a whole, and not from the exceptions occasionally found in the serial novels, and rarely in the novelettes—come to no other conclusion, than that it fails utterly of all the true purposes of fiction.

The department of essays is much better sustained. Topics of the highest moment to the race, and to the future prosperity of the nation are discussed with much boldness, and often with great ability. It is getting to be understood that if the thinking minds wish to reach the intellect and command the attention of the masses, false delicacy and fear to discuss social problems with plainness of speech must be discarded. The world has discovered that the principal obstacle to social progress has been too great reverence for things which have only custom to recommend them, and is now calling science to its aid to correct the evils which have thus grown to such dimensions as to threaten all good. Perhaps there is danger that, in the loss of reverence for such things as have no basis but custom and superstition, things essentially good may be underrated. Men seldom pass from one extreme without oscillating by the mean toward the opposite extreme; but we have hope that in all the struggle now going on to adjust human affairs upon a sounder and more rational basis, that the mean will at last be struck and rested upon.

In this struggle American magazine literature is taking a prominent place, though many of its essays upon social topics give little evidence of that cool and dispassionate thought which is the only way of arriving at truth. Many also show a sectional bias, and are flavored with prejudices, of early education and local circumstances. But with all these drawbacks, nothing but good can come of the fact that the public is brought to face squarely questions which it has for a long time shirked, and the settlement of which cannot be postponed more than one or two generations.

The labor question will, we predict, never be again allowed to rest until both labor and capital meet upon some common plane, satisfactory to employers and employed. There may be disasters to both, hard words, and even blows, before this desirable result shall be reached; but the world is too thoroughly aroused to the importance of a permanent settlement of this question to let it drop again without a final conclusion. What will be the basis of settlement it is impossible yet to predict, but that it will, when reached, distinctly define the rights of capital and labor, and recognize these rights as, in many respects, mutual and common, instead of antagonistic, we fully believe.

The social evil, with its long train of disease and misery, is also now to be in some way settled. The future of civilization demands that, on this subject, all lovers of mankind, should shirk neither thought nor utterance through regard to a foolish and false delicacy, which has hitherto prevented the general knowledge and appreciation of the magnitude of this disease of society. We are learning, and the magazines are helping us to learn that boldness of speech, is not begotten of impure thought, but that prurience begets shame-facedness.

We see, then, that the magazine literature of this country has two prominent features, the one essentially weak, the other essentially strong. The first is like the operatic music in our churches, performed to attract the unconverted and to fill the contribution boxes. Publishers cannot afford to risk success by filling their pages with essays alone, but we think they might afford to pay something more, and secure a better class of fiction, if fiction must be had to keep up the extent of their circulation.

THE FRANCO-PRUSSIAN WAR.

The war which for seven weeks has been waged between France and Prussia with such terrible destruction of life and property is virtually ended by one of the most brilliant and, on the part of the Prussians, the most successful campaigns of modern history. The French, though fighting with indescribable bravery and desperation, have not succeeded in making the least headway against their stern antagonists, and have not won a single victory worthy the name. Recent events, culminating in the surrender of McMahon's army and the capture of Napoleon, practically terminate the contest. It is impossible that the French nation can much longer hold out against superior skill and numbers. Shorn of its military *prestige*, it must now be content to rank for a long time as one of the inferior powers among the nations of Europe.

The war was worse than a blunder; it was a crime against civilization. The French inaugurated it, and civilization now rejoices at the just punishment they have received. To-day William of Prussia stands at the head of a victorious army with his territory unmolested, and all avocations of peace progressing as usual within its borders. France to-day not only weeps over thousands of brave hearts which have bitten the dust, but finds herself without a ruler, threatened with revolution and anarchy, with cities destroyed and fair fields ravaged, with commerce and manufactures almost suspended, and with an enormous increase of the public debt.

Why has Prussia won victory and France suffered defeat? Because the former had justice in her cause, superior numbers of the best soldiers in the world, armed with the best weapons ever yet supplied to so large an army, with superior generals in command, a complete commissariat, and one great head, Von Moltke, to direct. Her soldiers are intelligent, educated men, thoroughly drilled, and animated by a martial and patriotic spirit, which renders them probably the most reliable in action of any that ever advanced to meet a foe.

The French soldier is comparatively ignorant, and admitted by able French military authority—Trochu—to be impatient of discipline, and, although brave, more or less unmanageable in action. The over-cautious interference of Napoleon has embarrassed the generals of the French army; and the inefficiency of their commissariat, has been greatly aggravated by a succession of defeats which are not paralleled in modern times.

The Prussian soldier has the moral courage that comes through good education, as well as physical strength and courage, and the world is beginning to see, that, with the improved arms employed in modern warefare, something more than animal strength and courage is necessary to make good fighters.

The facts seem almost incredible. On the 15th of July—supported by his Government—the Emperor of France declared war against Prussia. On the 2d of August the first gun was fired by the French at Saarbruck, thence followed in rapid succession the sanguinary battles of Wörth, Haguenau, Gravelotte, Beaumont, and Sedan. On the 2d of September, the French armies had either surrendered or were closely besieged in their fortified places. The Emperor gave up his sword to his royal antagonist, King William, and became a prisoner. The Empire fell, a republic was speedily proclaimed; and France is humiliated in the eyes of all nations.

The Family Knitting machine, manufactured at New Haven, Conn., is said to be an excellent thing. We hear good reports respecting it.

A WOMAN locksmith, near Canal street, in this city, is said to do her work as well as a man.

THE SHEFFIELD SCIENTIFIC SCHOOL OF YALE COLLEGE.

The programme of this school for the college year beginning September 14, 1870, has recently been issued, and it is a much more interesting document than such announcements are apt to be. While it sets forth the peculiar advantages of the school, it also exhibits an example to the professors and directors of similar institutions that could be copied with advantage. The study of science has been attended with great unpopularity among men of letters for the reason that no provision was made in a majority of our schools for a systematic education. Classically educated men complained that the graduates of schools of science did not receive proper training in the use of language, and as a rule were not good writers. It is the aim of the Yale School to do away with all these objections, and to provide as good mental discipline as can be obtained in college. The Sheffield School is in fact a college, just as much as the academical department.

It has its separate corps of professors, although under the same board of trustees. We quote the language of the circular:

"While scientific and technical studies are made predominant, all candidates for the Bachelor's degree (of science) are also required to pay attention to linguistic studies; some knowledge of Latin being required for admission, and the study of German, French, and English being continued through the course. In other words, the school aims to make good scholars by modern methods for modern vocations."

The Yale School is a college for modern times, and by adhering to the programme above explained, the professors will relieve it entirely of unfavorable criticism.

The number of instructors in the Sheffield school is 23, a majority of whom are men of the highest rank in science and letters. We need only mention such names as Whitney, Brush, Johnson, Lyman, Trowbridge, Brewer, Gilman, Verrill, Marsh, Norton, and Lounsbury, to convince everybody that studying at the Yale School means earnest work, while the reputation of these men conveys the assurance of a thorough education.

In the combinations of the different classes, students are received who desire to qualify themselves for professions and occupations.

HARVARD SCHOOL OF DENTISTRY.

In addition to the regular Collegiate schools and those for Law, Theology, Medicine, Chemistry, Engineering, and other professions, the faculty of Harvard University, Cambridge, Mass., has established a Dental School, where those of the Harvard students who desire it, may attain thorough education in the science and practice of dentistry.

This school offers superior advantages, in that, while the instruction is no less thorough in those departments peculiar to dentistry, it gives the student unusual facilities for instruction in anatomy and physiology, surgery and chemistry, as the dental student pursues the same course in these branches as is required of the medical student, and, in common with him, has free access to the hospitals of the city, to the dissecting-rooms, and to the library and museum of the Medical College; and also to all the courses of the University lectures. These are special courses, delivered by men eminent in their departments; and they embrace a wide range of medical and collateral branches.

It is the object of the faculty to present a thorough course of instruction in the theory and practice of dentistry. For this purpose, a well-appointed laboratory and an infirmary are needed, and such arrangements as will insure a large number of patients.

The professors teach at clinics; and, under the direction of demonstrators, patients are assigned to the students, who thus have an opportunity of operating at the chair, and by actual practice become familiar with all operations demanded of the dental practitioner.

The infirmary which has been established in connection with the Massachusetts General Hospital remains open throughout the year, and offers to students unsurpassed facilities for acquiring practical knowledge and dexterity. During a period of sixteen months, the students attended to nearly *three thousand* patients, under the supervision of the faculty, whereby the patients were greatly benefited, and the students largely profited.

Dr. N. C. Keep, is the Dean of the Faculty, and may be addressed at No. 74 Boylston street, Boston, Mass.

The need of such institutions as the Dental School of Harvard, is greatly felt in this city. We have a few first rate honest and conscientious practitioners; but the number of dental quacks and mountebanks is quite large. There is always plenty of room here for good, intelligent, educated dentists, and they may be sure of liberal support. First class dentists, and some quacks who pass themselves off as such, earn from $25 to $200 a day in New York.

SCIENTIFIC INTELLIGENCE.

FIXING COLORS WITH SILICA.

Our some time correspondent, Dr. M. Reimann, describes in *Dingler's Journal* a series of experiments undertaken with the view to apply amorphous silica for absorbing coloring matter, such as fuchsine, aniline blue, and to use the dry powder thus prepared as a pigment, very much as smalt or ground cobalt glass has long been employed. The silica is prepared by precipitating a solution of water-glass (soluble quartz) with an acid, collecting, washing, and drying in the ordinary way. He states that glass can be stained by first etching its surface with hydrofluoric acid, then mordanting it in the same way as is done with cotton goods, and plunging it in a dye. The amorphous silica of the etched glass fixes the colors in the same manner as the loose powder. It is evident that this method opens up a way for the manufacture of pigments suited to wall paper, also for painting on wood. The silicified colors would also act as a protection to wood and cotton fabrics and render them uninflammable. The author does not state whether soluble glass if precipitated from colored solutions would produce lakes in the same way as alum solutions, from which we infer that it is not feasible, as this method would be more convenient for the manufacture of silica pigments then the one he proposes. This new process adds a further use for soluble glass, a notice of which valuable article we gave on page 104 of the current volume.

PURE HYDROFLUORIC ACID.

It is not an easy thing to prepare pure hydrofluoric acid. Here is what G. Gore says on the subject: Pass sulphureted hydrogen gas through the commercial article; neutralize sulphuric and other acids with carbonate of potash, decant, remove excess of sulphureted hydrogen gas with carbonate of silver, filter, distill from lead retorts with platinum condensers, and, if necessary, re-distill. The acid is then nearly chemically pure, and would have to be kept in platinum vessels. It can be diluted with distilled water to any extent, and is rarely required in a highly concentrated form. Of late years the use of the acid has been superseded by the employment of fluorides in etching and for other purposes.

SEPARATION OF SALTPETER AND NITRATE OF SODA.

The two nitrates of potash and soda are sometimes found mixed together, and it is desirable to have a convenient method for their separation; this is accomplished, according to Schultz, by taking advantage of the difference in the solubilities of the two salts in nitric acid. One part of saltpeter requires 1·4 parts nitric acid to accomplish its solution, while the Chili nitrate of soda takes 66 parts of nitric acid to dissolve it. The solubility of the soda salt does not appear to be materially modified by the presence of a larger or smaller quantity of saltpeter, nor is its solution much affected by temperature. In a small way, and for commercial tests, this method is said to work very well.

The Relative Merits of Bronze Steel and Iron for Field Artillery.

A correspondent of *Engineering* gives his views upon this subject through the medium of that journal, from which we condense the following:

Mere strength of material is not the only quality necessary in a metal to make a good cannon. Wrought iron is very much dearer, although very little stronger than cast iron, and yet cast-iron guns are being discarded, and built-up wrought-iron guns are being made instead. Steel is more than twice as strong (weight for weight) as wrought iron; nevertheless guns are not made of steel, because it has not been found suitable except as a mere lining.

As to bronze and its liability to burst, is there any use in shutting our eyes to actual experiments? Now the Prussians have made experiments as to the bursting of bronze guns; and the result of these experiments is to prove satisfactorily that if you have 1,000 guns of bronze of the ordinary weight and pattern, not one of them will ever burst. Here is what the Prussians did: "They turned down the gun of 6 cwt. (which throws a 9 lb. projectile), a small quantity at a time, until it weighed only 2 cwt., the thickness at the breech being reduced from 2·4 to 0·8 in., and at the muzzle from 1 to ¼ in. With this gun they made (step by step as they reduced its thickness) a series of experiments, firing a 9 lb. shell with a charge of rather more than 1 lb. of powder. When this gun was reduced to less than ¼ in., small cracks were observed through which powder gas escaped; nevertheless the gun was still fired with safety."

Facts are stubborn things. Here was this weak metal bronze, turned down to a thickness of only ¼ in. (far below what is absolutely necessary for another purpose that has nothing to do with strength, and which I will allude to further on), and yet it still fires a 9 lb. shot with a 1 lb. charge of powder, and does not burst. And not only that, but it actually gives (by incipient cracks), warning to the men that the minimum limit has been reached, and that prudence bids them cease firing.

And now one word as to weight. It is a sort of axiom that a gun ought to weight about 100 times as much as the projectile which it throws, and the gun and carriage together should weigh about 200 times the projectile, so as not to have too violent a recoil. But the lighter we can make the carriage, with due regard to strength, and the heavier the gun, the smaller will be the damage done by the recoil. Now, if a field gun has to throw a 9 lb. shot, it ought to weigh (exclusive of the carriage), about 900 lbs., and that weight is so great that a bronze gun, properly proportioned, will never burst. It is plainly, then, no object whatever to find for field artillery a material which is stronger than bronze in proportion to its weight. No doubt a bronze rifle to be fired from a man's shoulder, would strike most men as a little out of date; but the reason why is very plain. The rifle has to be carried long distances by a man (often a very little one), and to be held by him in a horizontal position when fired. Weight, therefore, is a serious matter. Yet, even here you will find the weight considerable in proportion to the projectile. A Snider rifle weighs 9 lb. 4 oz., or 64,750 grains, and it fires a bullet weighing 480 grains; so that the rifle is about 135 times the weight of its projectile. What wonder, then, that military men get rifles made of the lightest material consistent with strength and efficiency. I think I have said enough to show that bronze being a metal of only 17 tons strength to the square inch, is not, therefore, unsuited for use in field artillery. This being so, there are very good reasons for preferring it either to iron or steel; and the chief reason is the slowness with which it oxidizes. When the film of oxidation on bronze once forms to a trifling depth, it goes no further. Of this there is ample proof in bronze statues exposed to all weathers, and which, although centuries old, are still sound and perfect. But with iron and steel this is not so; for when once rust has set in, that rust continues to eat away at the metal until the whole is destroyed. We have often heard of honey-combed iron guns, but who ever heard of honey-combed bronze guns?

The patent laws are still in being, and if Sir Joseph Whitworth has a secret worth a penny, what a fool he is not to patent it, instead of running the risk of having his secret betrayed by some of his workmen. But Sir Joseph is a very wide-awake gentlemen; and as he does not patent it, the simple conclusion to be drawn is that he has no secret worth a patent fee, and his so called "yellow metal," like his proposed 35-ton gun, is a dream of the future.

Sir William Armstrong is not a military man, and yet the whole artillery of England has been revolutionized by him, under the auspices of "Government," and now it seems *we are retracing our steps* a little. His breech-loading system has long since been given up for heavy guns, and even for small guns it is now getting out of favor; so that in a few years in all probability the only trace of him will be found in the coil system for building up heavy guns, because we are quietly coming back again to bronze muzzle-loaders for field pieces.

As his great rival, Sir William, goes down, Sir Joseph Whitworth seems to think his opportunity is near, and so he is making great efforts just now in the hope of working a fresh revolution in English artillery, with much benefit no doubt to his own pocket, but with much detriment to poor John Bull, who pays the piper.

We may rest awhile on this Indian bronze field gun, which, although a muzzle-loader, can be fired 30 times in 7 minutes, or rather more than 7 shots per minute, or one shot in 8½ seconds! And considering that when firing case shot it scatters 108 bullets each shot, or 756 bullets per minute, it would not be a pleasant customer for either cavalry or infantry to charge up to. And seeing that a long range, say 2,665 yards, or 1½ miles, it will land a shrapnell shell (containing 63 bullets), somewhere within a strip 37 yards long and only 1½ *yards wide*, it is not a pleasant customer to have in front of you, even as a distance of one mile and a half. And seeing, too, that this is done without the aid of either Sir William Armstrong or Sir Joseph Whitworth, or of any of their inventions, our artillery officers or our Woolwich artificers, by whom this gun has been made, are not to be sneezed at.

The National Taxes.

The following statement of the provisions of the law of July 14th, in regard to sources of revenue, is compiled from official sources, and should be kept for reference:

Special taxes, including those on bankers, will cease May 1, 1871, excepting those connected with fermented liquors, spirits, and tobacco.

Taxes on gross receipts will cease October 1, 1870.

Taxes on sales will cease October 1, 1870, except those on sales of tobacco, spirits, wines, and those paid by stamps.

Taxes on income, including salaries, will be 2½ per cent on incomes over $2,000, instead of 5 per cent on incomes over $1,000.

Taxes on legacies will cease October 1, 1870.

Taxes on passports will cease October 1, 1870.

The use of stamps will cease October 1, 1870, for promissory notes for less than $100, for receipts, and for canned and preserved fish.

The receipts from these sources in the fiscal year 1870 were estimated at $83,016 000. The reductions have been officially estimated at at $55,000,000.

Fat People.—What Dr. Hall, in his Journal says of them.

Not long ago, a gentleman of threescore, who had scarcely ever been sick in his life, thought he was too fleshy, and began to Bantamize. He succeeded famously, and boasted to his friends that he had got rid of ten pounds in a few weeks. A little later he was attacked with a painful and dangerous malady, from which he has been suffering more than a year.

If a man can sleep soundly, has a good appetite, with no unpleasant reminders after meals, the bodily habits being regular every day, he had better let himself alone whether he is as big as a hogshead or as thin and dry as a fence rail.

Several cases of Bright's disease have been reported by medical men of reputation as a direct result of practicing Bantam's plan for getting lean. The very best and safest way to get rid of fat is to work it off; this may be aided by eating food which contains a large amount of nitrogen and a small amount of carbon. Nitrogenous food is that which gives strength power to work, as lean meats; carbonaceous foods are those which make fat, such as cheese, potatoes rice, corn, peas, beans, tapioca, arrow root, corn starch, milk, sugar, sirup, and all oily and fat food. Raw fruits and berries largely eaten are great aids to reducing weight. But after all, the great reliance should be on exercise and work in the open air. Barclay, the great English pedestrian, who performed greater feats than Weston, lost ten pounds in two or three days' walking, and was never the worse for it.

PLATINUM IN LAPLAND.—It appears that gold having been found some years ago in the neighborhood of the Ivalo river (Northerly Sweden), a more recent search there has given rise to the discovery also of some platinum, which, has also recently been found near Ibbenbühren, Westphalia.

The Storm Signal Service.

Under the direction of General Myers arrangements are rapidly being perfected for the commencement of operations by the storm signal corps, in every section of the country in which posts are to be established, for the purpose of noting the progress and direction of storms, and signaling the fact to distant points for the information of agricultural communities, and for other purposes. The greater number of the appointments of civilians to positions in the corps has already been made, and much care has been exercised in the selection of persons competent, both physically and mentally, to perform the somewhat onerous duties of the service. Quite a number of military officers, stationed with troops at posts in the West and North, have voluntarily put themselves under instruction in the prescribed duties, and will be a valuable addition to the regular force authorized by Congress, inasmuch as observations can be taken at a greater number of places. Four civilian appointees, who have become familiarized with the duties, have already been assigned to positions along the valley of the Upper Potomac in Maryland and Virginia. Several scientific institutions offer their hearty cooperation, and when the telegraphic arrangements are completed, and the entire force on duty, the beneficial effects of a practical operation of the system will be evident.

A Sad Disaster---Death of Capt. Cowper P. Coles.

News comes by telegraph across the water that the British iron-plated steamer *Captain* recently foundered off the coast of France. All on board, five hundred in number, perished. Among those who went down with the ill-fated steamer was Capt. Cowper Phipps Coles, of the Royal Navy. He was born in 1819, entered the navy in 1831, and rose rapidly in the service, displaying on various occasions a coolness and daring which surprised his superiors in years and experience. A plan devised by him for the construction of shot-proof rafts, guns, and mortars was subjected to an examination by a board appointed by the Commander-in-chief in 1855, and their report was so favorable that he was ordered to England, that his knowledge might be of use at the dock-yards of Portsmouth. The idea of protecting guns by shields was originated by him in 1855, and improved upon in 1859. In 1862 he adopted the turret system in the *Royal Sovereign* and other vessels in the British navy. His plans have been very extensively adopted in iron-clad vessels, and further improvements in naval engineering might well have been expected of him if his career had not been cut short by this terrible disaster.

Fair of the Maryland Institute.

The twenty-third annual exhibition of American Manufactures and Mechanic Arts, under the auspices of the Maryland Institute, will be held in the spacious hall of the Institute in Baltimore, commencing September 26, 1870, and continuing to Tuesday, October 25.

The fairs held by this Institute are among the most important and best managed of those held in this country.

Fair of the American Institute.—According to an nouncement this fair opened at the Empire Skating Rink in this city on the 7th inst. Considerable confusion yet prevails, and everything is in such disorder that it is impossible to notice the articles on exhibition as yet. In our next issue we shall probably be able to say something as to the merits of this exhibition.

Augusta County (Va.) Fair.—The third annual exhibition of the Augusta County (Va.) Fair Association will be held on the Fair Grounds, Staunton, Va., October 18th, 19th and 20th, 1870. The exhibition is open to all competitors, and a large list of premiums is offered. All sorts of agricultural implements and machinery, as well as miscellaneous machinery will be admitted. Mr. Jed Hotchkiss is the secretary and treasurer.

Fair of the Harrison County (Texas) Agricultural and Mechanical Association.—The First Annual Fair of this association will be held in Marshall, Texas, commencing Monday, November 7, 1870, and will continue six days. The secretary is W. W. Heartsill.

Mississippi State Fair.—The Second Annual Fair of the Mississippi State Fair Association will be held at Jackson, Monday, October 24th, to Saturday, October 29th, 1870, inclusive. Copies of the premium list will be mailed to any address on application to J. L. Power, Secretary, Jackson, Mississippi.

A Telegrphic Challenge.—The manager of the National Telegraph Company, using Little's telegraph instruments, having claimed that that system is much more expeditious than the Morse or other methods now in use, the President of the Western Union Telegraph Company has offered a challenge for a competitive trial of speed. Each party is to put up $1,000 stakes, and to use one wire. The same message to be sent by both parties, and to contain not less than two thousand words, which would be equal to two columns of the Scientific American. The Western Union to employ only two operators, one at each end of the wire. The National to be allowed six operators, three at each end. The challenge has not yet been accepted.

A monument to Kepler has been erected at Weildiestadt, in Suabia. It is a statue standing on a base adorned with bas-reliefs. In the astronomer's left hand is a parchment, on which an ellipse is drawn, and in his right is a pair of compasses. The bas-reliefs represent scenes from Kepler's life. The monument is the work of a sculptor of Nuremberg, named Kreling.

Facts for the Ladies.

I purchased a Wheeler & Wilson's Sewing Machine eight years ago, and it has been in constant use ever since, making the heaviest cloaks, besides doing my family sewing. I used one needle fifteen months without even removing it from the machine, and made, in the meantime, eighty cloaks, besides doing other sewing. I have used other machines, but consider yours the best. Mrs. P. Gordon.

Cedar Rapids, Iowa.

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 15c. a line

Pumping Water without Labor or Cost, for railroads, hotels, houses, cheese factories, stock fields, drainage, and irrigation by our self-regulating wind-mill. Strong and well tested. Con. Windmill Co., No. 5 College Place, New York.

The advertiser, having Patented a new method of Distilling Oils, desires to make arrangements with a party of capital, or owners of oil wells, with a view to its introduction. Address Abm. Quinn & Bro., Marcy ave., cor. Hopkins st., Brooklyn, L. I.

Our musical readers are referred to the advertisement of the "American Organs" of Messrs. S. D. & H. W. Smith, in another column.

Steam Gages, thoroughly made, no rubber or other packing. Address E. H. Ashcroft, Boston, Mass.

Foreman Wanted.—A Man to take charge of a Machine Shop, etc. A young man preferred. Murray, Moore & Co., Portsmouth, Ohio.

Paper.—Manufacturers or dealers in heavy, strong, waterproof paper please send address to F. A. Sinclair, Union Chair Works, Mottville, N. Y.

Chuck Lathe with Hollow Spindle, swings 42-in., cost $500. Good as new and for sale cheap. I. Lancaster, No. 77 N. Paca st., Baltimore.

Self-testing Steam Gages. E. H. Ashcroft, Boston, Mass.

Look at Baxter's Portable Steam Engine, on exhibition at the Fair of the American Institute, in New York.

Machinery, all kinds, made and sold by J. Dane, Newark, N.J.

Crampton's Imperial Laundry Soap, washes in hard or salt water, removes paint, tar, and grease spots, and, containing a large percentage of vegetable oil, is as agreeable as Castile soap for washing hands. "Grocers keep it." Office 81 Front st., New York.

Dickinson's Patent Shaped Carbon Points and adjustable holder for dressing emery wheels, grindstones, etc. See Scientific American, July 2ith, and Nov. 20, 1869. 61 Nassau st., New York.

Peck's patent drop press. Milo Peck & Co., New Haven, Ct.

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

Profitable Canvassing.—"Universal Sharpener," for Table Cutlery and Scissors. A correctly beveled edge can be obtained. See Adv't.

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

J. R., of Leipzig, Germany.—If 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.

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.

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.

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.

"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.

One 60-Horse Locomotive Boiler, used 5 mos., $1,200. Machinery from two 500-ton 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. H. 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 Patented in England by Americans.

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

PROVISIONAL PROTECTION FOR SIX MONTHS.

2,314.—Wood Pavement.—W. W. Ballard, Elmira, New York, August 9, 1870.

2,328.—Pumps.—G. C. Bishop, Montreal, Canada. August 11, 1870.

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.

C. D. C., of Mo.—The amount of diametric contraction before rupture takes place in bars exposed to tension has been found to vary greatly with the rapidity of application of the stress. The amount of elongation also so varies, both being greater when the stress is applied gradually than when it is applied suddenly. The amount of bending in transverse rupture also varies in the same way. The breaking load in good iron is often nearly the same as for steel if they have been worked by a similar method. The word steel now comprises various metals containing different ingredients in various proportions. We should like to have some one invent a good definition for the word steel; we know of none that exactly answers the purpose in the present state of metallurgic science. Any alloy of iron or combination of it with carbon, silica, boron, chromium, etc., is now called steel, and without further definition it is impossible to determine which is meant by steel.

H. A. W., of N. C.—We know of nothing that equals in convenience of application with efficiency the asphaltum of the gas works as a protection to iron from the oxidizing action of water. Two or three coats applied hot and allowed to become perfectly hard will keep iron from rusting a long time. Of course neither this nor any other similar substance can be used on a surface exposed to wear without soon exposing the metal surface. When properly applied it will not give taste or smell to water except for a short time.

D. M. P., of Cal.—The expansion of homogeneous solids by heat is for the most part proportionately the same in their various dimensions. There are, however, exceptions. Wood expands more in the breadth of its fibers than in length. Lead permanently changes its form by heating and cooling, and it is probable that there are other metals which do the same thing in a very small degree. It has been asserted that iron has manifested this peculiarity under certain conditions.

G. R. S., of Me.—Rodman's perforated cake powder was made in solid cakes, the cakes being subjected to a pressure equal to what they would be subjected to in the gun, and also being perforated with holes to permit access of flame. The object of this was to make the powder burn slowly, so that heavy projectiles might attain their maximum initial velocity gradually, and thus subject the gun to less strain than when quicker burning powder is used.

D. R. T., of Cal.—Your device for mixing mortar is not patentable. You will find almost an exact description of it, with engraving, in Gilmore's treatise on Limes, Mortars, and Cements. It was invented by M. Greyveldinger, and used by him in Paris on public works. The materials were fed into a hopper and passed through a horizontal cylinder in which revolves a long series of screw blades which delivered the mixed mortar into buckets or tubs at the end.

T. B., of N. J.—No definite advice can be given you in respect to the state of your boiler except through the personal examination of an expert. There are plenty of men in your city who can and will give you advice on application. It is quite evident you know too little of boilers to rely upon your own judgment. Get a practical man of experience to look at it.

L. M., of N. J.—The following recipe for blacking for harness is highly recommended: Treacle, ½ lb.; lamp black, 1 oz.; yeast, 1 spoonful; sugar candy, olive oil, gum tragacanth, and isinglass, each 1 oz., and one ox gall. Mix with two pints of stale beer, and let it stand before the fire for an hour.

D. R., of La.—You can make a useful tracing paper of larger size than you can purchase by brushing over one side of good thin unsized paper a varnish made of equal parts of Canada balsam and turpentine. If required to take water color it must be washed over with ox-gall and dried before being used.

L. G., of Fla.—You can keep ink made from the bark of the witch hazel, or from any other vegetable substance, from molding by putting into it creosote or carbolic acid. Only enough to give a distinct odor is required. Cloves will also keep ink from spoiling.

A. N., of Vt.—There are devices for burning hydrogen and oxygen in a steady jet without danger of explosion. Hans' oxy-hydrogen blow-pipe is the best. This flame (you can use more than one if you wish) will give you all the heat you require, if, as you say, expense is not an object.

G. P. R., of Conn.—A Daniell battery will sometimes act for twenty days or more without renewal or attention where the current is not constantly employed. In telegraph offices we believe they require renewal every ten or fifteen days.

L. D., of Texas.—Any gaseous envelope about the sun or a planet would be called its atmosphere. It is not necessary that it should be composed of oxygen and nitrogen. It might contain even vapors of solid substances.

T. N. R., M.D., of Ga.—Dr. Bastian's work, "The Beginnings of Life" can be obtained of Macmillan & Co., of New York, and the papers referred to were published in the July numbers of *Nature*.

D. G. B., of Tenn.—The numbering of spectacle glasses is, in England and America, purely arbitrary. In Continental Europe the numbers indicate the radius to which the curvature of the glasses are found.

Recent American and Foreign Patents.

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

Combined Wood and Iron Paving Block.—John S. Kelly, New York city.—This invention has for its object to furnish improved blocks for paving streets, which shall be more durable, and more conveniently laid than the ordinary wood pavement blocks, and which will allow the pavement to be readily taken up for repairs, the laying of sewers, water pipes, gas pipes, etc., and which may again be relaid with the same blocks.

Combination Spring Power.—John M. Cayce, Franklin, Tenn.—The object of this invention is to provide for public use a spring power so constructed that any required number of springs may be employed, winding up by the same shaft, but independently of each other. In applying their power to the working shaft, the operator can, at will, use any one, or any number of the springs at the same time, so that, although a force sufficient to overcome only one spring is necessary to wind up the apparatus, yet the combined power of all the springs is available whenever needed, or they may be used separately one after the other.

Harvester.—Daniel Stukey, Lancaster, Ohio.—This invention consists in the combination of a saw blade with the knives of a harvester in such a manner that the teeth of the saw blade project forward of the points at which the inclined sides of the knives meet, so far as to prevent stalks of grass or grain from collecting in the corners between the knives and choking or clogging the same.

Lamp Shade Holder.—John Foller, Washington, D. C.—This invention relates to an improvement in shade holders for lamps, and consists of a peculiarly constructed hinged band which secures the holders to the neck of the lamp, and a frame constructed of two wires, the lower end of which serve as pintles for the hinges of the band.

WAGON JACK.—Jeremiah W. Walton, Decatur, Mich.—The main feature of this invention is a device for varying the hight of the jack lever without lowering it on the standard in order to readily adapt it to axles of different elevations; there being also other minor improvements.

FEED-WATER HEATER.—Daniel Lordon, Memphis, Tenn.—This invention relates to improvements in feed-water heaters for steam boilers or generators, and consists in the peculiar construction and arrangement of the terminations of the coil of pipe which traverses the furnace chamber, whereby a circulation of water is maintained when the "doctor" or feed pump is stopped.

STEADFAST AND TRAVELING AUTOMATIC HAY FORK PULLEY.—Charles R. Foreman, West Branch, N. Y.—This invention has for its object to furnish an improved device for carrying a loaded hay fork or other weight from the place where it is hoisted to the place where the load is to be deposited, which shall be so constructed and arranged as to be held steadily in place until the fork or other weight has been raised, and which will then detach itself automatically and carry the said weight back to the place where it is to be deposited, and which shall be, at the same time, simple in construction and easily operated.

ADDING MACHINE.—Gilbert W. Chapin, Brooklyn, N. Y.—This invention has for its object to furnish an improved adding machine, simple in construction, easily, conveniently, and rapidly operated, and accurate in operation.

REVOLVING DOUGH AND CAKE MIXER.—Thomas Holmes, Williamsburgh, N. Y.—This invention has for its object to improve the construction of an improved dough mixer, patented June 15, 1869, and September 21, 1869; and numbered respectively 91,335, and 95,021, so as to make it more convenient and effective in use.

ROLLING MILL.—William Brown, David Brown, and Francis Watkins, Smithwick, England.—This invention has for its object to facilitate the rolling of large and heavy masses, or bars of iron, steel, and other metals, and to obviate the necessity of lifting the said heavy bars or masses from one grove to another of the rolls as is necessary in rolling by the ordinary machinery, and to dispense with the three-high rolls and the heavy machinery required for the ordinary reverse gear.

TOP FOR SHEET-METAL CANS.—James Britton, Williamsburgh, N.Y.—This invention has for its object so to construct sheet-metal covers for cans and boxes, that the circular piece cut out in the center of each cover will be supported by the inner part of the cover proper, so that it may be soldered down and unsoldered, without becoming destroyed during the opening of the can.

LETTER FILE.—John Cash and Joseph Cash, Jr., Coventry, England.—This invention has for its object to furnish an improved receptacle for filing away letters, papers, and other documents, to preserve them in an open state for convenient reference.

LOG TURNER.—William E. Hill, Erie, Pa.—This invention has for its object to furnish a simple, convenient, and effective device for turning logs and other timber upon the carriage of a saw mill.

FOUNTAIN PEN.—Gustav Adolph Becker, Seymour, Conn.—This invention has for its object to furnish an improved fountain pen, simple in construction, and convenient and effective in use.

PHOTOGRAPHIC BACKGROUND.—Daniel W. Van Riper, Columbus, Ga.—This invention has for its object to produce a negative from the camera, which, with the exception of the figure or figures to be represented on the card or larger picture, shall be perfectly bare glass or as transparent as the deepest shadows of the said picture producing a dark background and lighting up the darkest outlines of the figure or figures to any desired extent, so that the figures may be clearly outlined; or, in other words, accomplishing the reversion of the lights and shadows of the subject and background relatively, according to the wishes of the operator, the circumstances of the case, and the effect desired to be produced.

WASHING MACHINE.—John Prehn, New York city.—This invention relates to a new machine for washing clothes, and consists in a novel mechanical movement for imparting a peculiar scooping, rolling, and pressing action to the plunger by which the garments are agitated.

COMBINED CORN PLOW AND CULTIVATOR.—Jacob M. Landes, Sanders, Pa.—This invention has for its object to furnish an improved machine, simple in construction and effective in operation, and which may be easily and quickly adjusted for use as a corn plow or cultivator, as may be required.

METAL ROOFING.—Seymour Hughes, Hudson City, N. J.—This invention relates to a new joint for connecting metal roofing plates and to a novel arrangement of providing water courses, with transverse, projecting joints and has for its object to combine great strength with simplicity of construction, so that the joints will be durable and comparatively inexpensive, while a free escape of water is provided at the end of each joint, so that the water cannot accumulate on any part of the roof.

FIRE PLACE FOR GRATES.—T. W. Baird, Bowling Green, Ky.—This invention relates to a new fire place for grates, and has for its object to increase the radiating surface back of the fire so as thereby to augment the heating capacity of the same.

BREAST STRAP PROTECTOR.—L. R. Ward, Ward's Corners, Iowa.—This invention relates to a new lining for breast straps, whereby the wearing of the same by the neck yoke ring will be prevented. The invention consists in the combination of a curved shield with two links which are hinged to the ends of the shield to clamp the same against the breast strap.

ADJUSTABLE DIE FOR MOLD-BOARDS.—J. H. Franklin, Avoca, Wis.—This invention consists in forming a die for curving or bending plates of metal into the shape of a plow mold-board by means of screws passed through movable plates pressed towards each other be means of cams, the mold-board being formed on the ends of the screws.

FIRE ESCAPE.—William Miller, Boston, Mass.—The object of this invention is to provide a convenient and reliable apparatus for bringing a fire ladder to any desired position, and for retaining it therein for use.

MEDICAL COMPOUND.—Michele Ferro, Iuka, Miss.—This invention and discovery relates to a new and useful composition to be used as a medicine for the cure of chills and other diseases.

PISTON PACKING.—John Keesey, Chester, Pa.—This invention relates to a new and useful improvement in the mode of packing the pistons of steam engines whereby the packing rings are made self adjusting, and the piston is made to work steam tight in the cylinder, and the invention consists in a grooved central ring on the spider of the piston, and in segmental packing rings in combination therewith.

WIRE CUTTER.—Joseph Johnson, Marshalltown, Iowa.—The object of this invention is to provide simple and efficient means for cutting up wire into pieces of uniform length, and at the same time provide a rule by means of which the wire is measured to any desired length and the gage set thereby.

HEEL ROUNDING MACHINE.—J. C. White, Auburn, N. Y.—This invention has reference to a new and improved machine for rounding the heels of boots and shoes of all sizes, whereby much labor and valuable time are saved.

COMPRESSED AIR FORGE HAMMER.—Charles Vogel, New York city.—This invention relates to a new and useful improvement in hammers for forging iron and other metals which are actuated or partially actuated by compressed air, and it consists in the mode of controlling the air and regulating the stroke of the hammer, and in the arrangement and combination of parts.

HAIR ROLLS.—J. H. Vogt and George Dietzel, New York city.—This invention relates to a new manner of holding rolls for ladies' hair, distended by means of a spiral spring which tapers towards its ends to fit the roll.

COMBINED MARKING AND BORING MACHINE.—G. M. Nickason, Ellenville, N. Y.—This invention has for its object to provide a machine for marking carpenters' stuff, such as is used on window frames, sashes, shutters, etc., and the invention consists in the application of a rotary marker, which has also a laterally reciprocating motion, to produce marks of suitable length with great precision and exactness.

HARROWS.—Stephen Woodard and Albert Woodard, Saratoga, Ind.—This invention relates to a new and useful improvement in harrows for cultivating the soil whereby such implements of husbandry are made much more useful, convenient, and durable than they have hitherto been, and it consists in making the harrow self-adjusting, by means of which it will pass between stumps, rocks, and narrow spaces and immediately assume its full width and proper proportion.

FRUIT BASKETS.—Richard Mitchell, Smyrna, Del.—This invention relates to a new and useful improvement in baskets for holding and transporting fruits, vegetables, and other articles, and it consists in securing the staves by beveled hoops, and in curving the staves and side of the basket, and in the mode of ventilating the contents.

TANNING MACHINE.—John Robinson, L. F. Robinson, and C. C. Putnam, Skowhegan, Maine.—This invention relates to a new and useful improvement in a machine for tanning hides whereby the process of manufacturing leather is greatly facilitated, and it consists in a tanning cylinder whose outer surface or periphery is formed of movable lags or bars separated by narrow spaces and provided with brads from which the hides to be tanned are suspended on the inside of the cylinder, the said cylinder being revolved in a vat or tank partly submerged in the tanning liquor.

OPERATING VALVES.—A. L. Pennock, Upper Darby, Pa.—This invention relates to a new and useful improvement in operating valves whereby they may be arranged in short tubes of small diameter, and removed from the tube with great facility, and it consists in opening and closing the valve by means of a screw valve stem connected with the valve by a ball and socket joint, the socket being slotted and the valve being connected with the tube by means of a hinged arm.

PENCIL SHARPENER.—M. W. Dillingham, Amsterdam, N. Y.—This invention relates to a new and useful improvement in sharpeners for lead pencils whereby they are made more convenient and useful than they have hitherto been, and it consists in forming the sharpener in two separate principal parts connected together by a band and screw nut, clasp, or snap joint.

GAIN CHISEL.—Hiram Bigelow, Skowhegan, Maine.—The object of this invention is to provide a tool for facilitating the operation of letting butt hinges into window blinds, shutters, doors, trunks, and for all purposes for which butt hinges are used when they are let into the wood.

MACHINERY FOR MAKING HARD AND SOFT GIMP.—Thomas U. Dale, Jr., and Geo. Kranik, Paterson, N. J.—This invention relates to improvements in machinery for covering cotton or other material for making hard or soft gimp, and consists in an arrangement of the bobbins containing the covering material on a supporting disk or table, permanently attached to the frame, and a twister or covering device in connection therewith, in such a manner that the covering is accomplished by the rotation of the twister. The object is, by twisting the silk equally around the cotton, to cover with less silk than is done in the ordinary manner, where the silk and cotton are both twisted together, by means of an ordinary flyer, around each other. This machine twists them together, too, but the twisting, being done centrally, through a hollow spindle, the cotton is kept in the center, and silk is drawn up around it.

TREADLE MOTION.—Charles M. Guess, New Orleans, La.—This invention relates to improvements in treadle motions for sewing machines, turning lathes, and the like, and consists in a combination with two loose pulleys on the shaft to be driven, carrying pawls, working in ratchet wheels, fixed to the said shaft, and having springs to impart the back motion for winding on the belts, which give the forward motion, and with the belts for actuating the said pulleys of a treadle, vibrating on pivots, to the long arm of which one belt is connected, and an arm projecting from the side of the shaft on pivots opposite to that where the belt is connected to the treadle, to which arm the other belt is connected, so that while only one treadle is used, the belts will be worked in opposite directions, one winding up on the pulley which is returning, while the other is winding off its pulley and impelling the shaft.

COTTON-GIN FEEDER.—J. Ralston, Brenham, Texas.—This invention relates to improvements in apparatus for feeding cotton gins, and consists in an arrangement in a frame adapted for ready attachment to the frame of a saw gin on the receiving side, of an endless apron, toothed rollers, and toothed distributing and equalizing bars, in a manner to spread and equalize the cotton, before it is delivered to the saws, and to separate the said dirt, gravel, nails, and other like matters, to prevent contact with the saws and injury to them, and the danger of igniting the cotton, and thereby to improve the quality of the lint.

COVERING METAL ARTICLES WITH INDIA-RUBBER.—Constantine Hingher, New Brunswick, N. J.—This invention relates to new and important improvements in covering buckles and other metal articles with india-rubber, and consists in the employment of varnish, soap, or other substances which will expand under the action of heat, between the surface of the metal article to be coated and the coating of rubber, for preventing the india-rubber coating from shrinking away from the walls of the mold while confined in it, in the vulcanizing process, which shrinkage is very damaging to the coating which, not being confined upon the smooth surface of the mold becomes rough and requires considerable finishing after removal, and is often wholly ruined.

WATER WHEEL.—Geo. Miller, Providence, R. I.—This invention relates to improvements in water wheels, and in the gearing for transmitting the power of same. It consists in mounting the large wooden or iron breast overshot or similar wheels, commonly mounted on central shafts, on friction rollers, and in transmitting the power through the medium of the said friction wheels, geared together and arranged for gearing with suitable transmitting gear, the object being to simplify and cheapen the cost of the wheel and transmitting gear, as well as to reduce the friction of the bearings of the wheel.

PULLEY LUBRICATOR.—Joseph E. Hendrick, Waterbury, Conn.—This invention has for its object to provide a lubricator attachment to loose pulleys whereby the bearings of the same, on the shafts, will at all times be properly oiled. The invention consists in arranging within the lubricator cup a tube, and within said tube a short movable valve, which has a groove or channel cut into its bearing surface. The valve is thrown up and down in the tube during the rotation of the pulley, but allows the oil to flow under it through the groove when it rests on the seat.

SHUTTLE FOR LOOMS.—Theodor Bozshard, Columbus, Ohio.—This invention has for its object to so construct shuttles for looms that their motion will be arrested immediately after the breaking or giving out of a thread. The invention consists in the application to the shuttle of a self-acting drop lever which is held up by the thread, while the same is held tense, but which, when the thread breaks or becomes slack, immediately swings out to project from the shuttle and prevent its further movement by coming in contact with some stationary part of the loom.

WALKING CULTIVATOR.—B. F. Osborn, Nashville, Tenn.—This invention relates to improvements in the construction and arrangements of the joints of the horizontal bars of the frame of cultivators with the axle and the hitching apparatus, to make permanent and durable joints, and to provide for moving the frame vertically and horizontally. It also relates to improved apparatus for connecting the handles to the beams of the frame for adjustment and for rigidly holding them.

FURNITURE FASTENING.—Leonard A. Johnson, Candor, N. Y.—This invention relates to improvements in fastenings for the joints of bedsteads and other articles of furniture which are required to be taken apart frequently. The invention consists in the application to the side rails at the ends and on one side of a cross-piece of wood or metal, having a pair of tapered dovetailed lugs, one at each end, which fit into correspondingly shaped notches in a piece of wood or metal attached to the post or part to which the side rail is to be attached.

SCRUBBING BRUSH.—J. Odell, Petroleum Center, Pa.—This invention relates to that class of scrubbing brushes which are operated by a person standing, and by means of a long handle. It consists in forming two distinct and independent brushes upon the same block, at a wide interval apart, and with a shorter stiff intermediate strip placed centrally between them

MEASURING FAUCET.—Francis C. Heiser, Williamsburgh, N. Y.—This invention has for its object to construct a measuring faucet for casks, cans etc., whereby the desired quantity of liquor will be drawn, and no more

SHAFT COUPLING.—Marshall S. Bassett, West Haven, Conn.—This invention relates to a new shaft coupling, which is of very simple construction, but so arranged as to firmly lock two shafts together, permitting their being taken apart whenever desired.

CHURN.—Hermann Kuhlmann, Cincinnati, Ohio.—This invention relates to a new mechanism for operating churn dashers, and to a novel construction of dashers, and has for its object to facilitate the production of butter by a thorough agitation of the cream.

MUSICAL ROCKING CHAIR.—Clayton Denn, Frankford, Philadelphia, Pa.—This invention has for its object so to construct a rocking chair that its motion may be utilized for working a bellows and producing music.

CHURN DASHER.—Thomas H. Weaver, Marietta, Ga.—This invention relates to improvements in churn dashers, and consists in a short cylinder of sheet or cast metal, with perforations in the sides, and having a perforated disk at the center, to the center of which is a screw-threaded tube, by which the dasher handle is attached.

COVERING METAL ARTICLES WITH INDIA-RUBBER.—Constantine Hingher New Brunswick, N. J.—This invention relates to improvements in covering metal articles with India-rubber. It is designed mainly for covering hames and is intended to overcome the difficulties arising from the action of the air confined in the clefts and cavities in the surface of the iron, also from the gases generated by the scale on the surface.

LIME KILN.—Daniel Hills, Richville, N.Y.—This invention relates to a new lime kiln, which is so constructed that in it a full charge of lime can be thoroughly burnt, while the kiln will be preserved and ready for continuous use. The invention consists in constructing the kiln wider at the bottom than at the top, so that the products of combustion will be retained in it long enough to utilize their entire heat.

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106,981.—CORN PLANTER.—Michael Ackermann, Steamboat Rock, Iowa.

106,982.—GANG PLOW.—J. H. Andrews, Benicia, Cal.

106,983.—EGG CARRIER.—J. R. Asher (assignor to himself and R. I. Robeson), Oskaloosa, Iowa.

106,984.—DETACHABLE BOOT AND SHOE HEEL.—Charles W Bailey, Boston, Mass.

106,985.—FIREPLACE.—Thomas W. Baird, Bowling Green, Ky.

106,986.—MOP.—Charles L. W. Baker, Hartford, Conn. Antedated August 25, 1870.

106,987.—FOUNTAIN PEN.—Gustav A. Becker, Seymour, Conn.

106,988.—STAVE JOINTER.—John B. Bell, Pittsburgh, Pa. Antedated August 25, 1870.

106,989.—WOOD PAVEMENT.—Albert Betteley, Boston, Mass.

106,990.—STREET LAMP.—Emil Boesch, San Francisco, Cal.

106,991.—TOP FOR SHEET-METAL CANS.—James Britton (assignor to himself and Garrett Brower), Williamsburgh, N. Y.

106,992.—ROLLING MILL.—Wm. Brown and David Brown, Smithwick, England.

106,993.—PULLEY MECHANISM.—William H. Brown, Bangor, Me.

106,994.—GRAIN SEPARATOR.—John D. Brunner and Edwin R. J. Ueberroth, Doylestown, Pa. Antedated August 26, 1870.

106,995.—FLOOD BRIDGE.—Thomas Alfred Bryan, Baltimore Md.

106,996.—FRUIT LADDER.—C. S. Cannon and C. D. Cannon, Chicago, Ill.

106,997.—BEDSTEAD FASTENING.—Wm. H. Carter, Candor, N.Y.

106,998.—WHIP SOCKET.—Edwin Chamberlin, Lansingburg, assignor to himself and J. O. Marriam, Troy, N. Y.

106,999.—ADDING MACHINE.—Gilbert W. Chapin, Brooklyn, N. Y.

107,000.—MODE OF FORMING UMBRELLA HANDLES FROM PLASTIC MATERIAL.—Levi Chapman, New York city. Antedated Aug 26, 1870.

107,001.—BUTTON-HOLE SEWING MACHINE.—Wm. Chicken, Chelsea, Mass.

107,002.—METHOD OF HANGING GRINDSTONES.—Henry M Church, Brunswick, Ohio.

107,003.—FRUIT JAR COVER.—T. A. Clark and H. C. Mascroft, Worcester, Mass.

107,004.—HARVESTER RAKE.—Daniel Clow, Janesville, Wis

107,005.—DEVICE FOR LUBRICATING, COOLING, AND WASHING VERTICAL HAMMER SHAFTS OR STAMPS.—Z. E. Coffin, Newton, Mass. Antedated August 24, 1870.

107,006.—WIRE FOR WIRE GOODS.—W. F. Collier, Worcester, Mass.

107,007.—WATER WHEEL.—J. M. Cook (assignor of one half his right to B. J. Cole), Lake Village, N. H.

107,008.—RAILWAY CAR COUPLING.—R. Cowell, Cleveland, Ohio. Antedated July 15, 1870.

107,009.—BUTTON-HOLE CUTTER.—D. H. Cunningham, Waltham, Mass. Antedated Aug. 30, 1870.

107,010.—MACHINE FOR COVERING CORD.—T. N. Dale, Jr., and George Kraink, Paterson, N. J.

107,011.—MAXILLARY COMPRESS.—C. E. Davis, St. Helena Cal.

107,012.—BEEHIVE.—Enos Davis, Noblesville, Ind.

107,013.—WARDROBE, BEDSTEAD, AND BUREAU.—J. R. Davis and Frederick Rominger, Bloomfield, Iowa.

107,014.—PADDLE WHEEL.—David De Haven, New Orleans, La.

107,015.—COOKING TABLE.—Eliza D. Dodge, Worcester, Mass.

107,016.—IMPLEMENT FOR CUTTING THREAD.—Frederick Egge and R. W. Churchill, Bridgeport, Conn.

107,017.—BRICK MACHINE.—J. S. Elliott, Boston, Mass., assignor to Union Stone Co.

107,018.—HAND RAKE.—Minot Ellis, Greenfield, Mass.

107,019.—FEEDING MECHANISM FOR SEWING MACHINE.—G A. Fairfield, Hartford, Conn.

107,020.—FENCE.—Edward Fales, Glenwood, Mo.

107,021.—BURGLAR-PROOF SAFE.—John Farrel, New York city.

107,022.—FILLING FOR FIRE-PROOF SAFE.—John Farrel New York city.

107,023.—MECHANISM FOR OPENING AND CLOSING SAFE DOORS.—John Farrel, New York city.

107,024.—MEDICAL COMPOUND FOR THE CURE OF FEVER AND AGUE.—Michele Ferro, Iuka, Miss.

107,025.—CORNER SUPPORT FOR CARRIAGE BOXES AND SEATS.—William Fisher, Marathon, N. Y.

107,026.—LAMP SHADE HOLDER.—John Foller, Washington, D. C.

107,027.—COMPOUND FOR DESTROYING THE ODIUM IN VINES, PLANTS, ETC.—C. P. Folliet, Amonce, France.

107,028.—ELEVATOR.—Charles R. Foreman, West Branch, N. Y.

107,029.—BALANCING MILLSTONE.—Charles V. Foreman, Mechanicstown, Md. Antedated Aug. 26, 1870.

107,030.—GAME BOX FOR TEN PINS.—George B. Fowler, Brooklyn, N. Y.

107,031.—SELF-WINDING COUNTER SPOOL.—W. J. Fox, Morrisania, N. Y.

107,032.—ADJUSTABLE DIE FOR BENDING MOLD BOARD.—Jonathan B. Franklin, (assignor to himself and J. P. McAllister), Avoca, Wis.

107,033.—PLOW.—Horatio Gale, Albion, Mich.

107,034.—CAR SPRING.—Perry G. Gardiner, New York city.

107,035.—CAR SPRING.—Perry G. Gardiner, New York city.

107,036.—CAR SPRING.—Perry G. Gardiner, New York city.

107,037.—PLOW.—Robert Gibbs, Brunswick, Mo.

107,038.—HAY LOADER.—H. L. Gockley, Jackson, Ill.

107,039.—HARVESTER.—Lewis Hall, Metamora, Ill.

107,040.—GRAIN DUMP.—William H. Hall, Jr., Bloomington Ill.

107,041.—SEWING MACHINE.—C. F. Harlow, Boston, Mass. Antedated August 27, 1870.

107,042.—SAFE CASE FOR BOOKS.—S. H. Harris, Chicago, Ill.

107,043.—FRAME OF SAFE CASE FOR PAPERS.—S. H. Harris, Chicago, Ill.

107,044.—LUBRICATOR.—J. E. Hendrick (assignor to himself and Philo Brown), Waterbury, Conn.

107,045.—MOCCASIN BOOT AND SHOE.—Thomas Hersey, Bangor, Me.

107,046.—PEN FOR RULING MACHINES.—Wm. O. Hickok, Harrisburgh, Pa.

107,047.—BEEHIVE.—J. M. Hicks, Indianapolis, Ind.

107,048.—SCHOOL SEAT.—George W. Hildreth, Lockport, N. Y.

107,049.—HOBBY HORSE.—C. Hitzelberger, South Orange, N. J.

107,050.—DOUGH AND CAKE MIXER.—Thomas Holmes, Williamsburgh, N. Y.

107,051.—MACHINE FOR MAKING TUBULAR LIGHTNING CONDUCTORS.—B. F. Housel and S. O. Thayer, Winona, Minn.

107,052.—SULKY PLOW.—Benj. R. Hubbard, Hillsborough, Ill.

107,053.—SEPARATING STONES, ETC., FROM CLAY, ETC.—D. J. Hunter, Boston, Mass.

107,054.—TEAPOT OR WATER HEATER.—Edward Hunter (assignor for one half his right to H. H. Gallup), Norwich, Conn.

107,055.—SLEIGH KNEE.—Obadiah Johnson, Lassellsville, N. Y. Antedated August 25, 1870.

107,056.—SEEDING MACHINE.—J. Herva Jones, Rockford, Ill.

107,057.—HARROW.—Wm. P. Jones, Arcade, N. Y.

107,058.—BALE TIE.—W. A. Jordan, New Orleans, La.

107,059.—PAINT COMPOUND.—W. N. Jordan, Cambridge, Mass, assignor to himself, P. M. Smart, and H. W. Cook.

107,060.—GARDEN HOE.—A. C. Judson, Grand Rapids, Ohio.

107,061.—CAN OPENER.—Joseph Kaufman, New York city.

107,062.—PISTON PACKING.—John Keesey, Chester, Pa.

107,063.—PLOW FOR CUTTING POTATO ROOTS.—H. M. Keith, Commerce, Mich.

107,064.—SHOE FASTENING.—Jonathan Coykendall, Farmington, Ill.

107,065.—COMBINATION GAME BOARD.—Conrad Krath and G. H. Moll, St. Louis, Mo.

107,066. PECTORAL SIRUP OR MEDICINE.—G. La Montague, Muskegon, Mich.

107,067.—PAPER FOR PRINTING, WRITING, AND OTHER PURPOSES.—John Langtree, New York city.

107,068.—INSTRUMENT FOR DRAFTING GARMENTS.—U. L. Leete, Owego, N. Y.

107,069.—CULTIVATOR.—J. R. Little, Galesburg, Ill.

107,070.—FRUIT CARRYING BOX.—G. A. Lloyd, San Francisco, Cal.

107,071.—PROCESS OF OBTAINING OZONE OR OZONIZED AIR.—Oscar Loew (assignor to R. D. Turner and Wellwood Murray), New York city.

107,072.—VAPOR BURNER.—J. F. Marsh, Dubuque, Iowa.

107,073.—FLOWER-POT, VASE, AND BASKETS.—Thomas McClunie, Hartford, Conn.

107,074.—FIELD ROLLER.—R. C. McConaughy (assignor to James Reynolds, Sr.), Ripley, Ohio.

107,075.—TELEGRAPH INSULATOR.—Samuel McKee, Pittsburg, Pa.

107,076.—BUCK BOARD WAGON.—Michel Miller (assignor to himself and William Hewson), Buffalo, N. Y.

107,077.—FIRE ESCAPE.—William Miller, Boston, Mass.

107,078.—REACTION ROTARY STEAM ENGINE.—F. E. Mills, San Francisco, Cal. Antedated August 26, 1870.

107,079.—KEROSENE STOVE.—R. B. Mitchell, Chicago, Ill.

107,080.—FOLDING COAT AND HAT RACK.—J. H. Monce, New York city.

107,081.—ROTATING ENGINE.—D. S. Money, Valdosta, Ga.

107,082.—CARRIAGE POLE COUPLING.—C. A. Moore, Akron, Ohio.

107,083.—CONSTRUCTION OF CAR WHEELS.—J. K. Morange and N. B. Morange, Pittsburgh, Pa.

107,084.—FOLDING CHAIR.—E. P. More and S. J. Anderson, Cazenovia, N. Y.

107,085.—TRACE HOOK.—W. H. Morgan, Alliance, Ohio, assignor to himself and R. B. Geyer, Allegheny, Pa.

107,086.—TRACE-HOOK AND CLIP FOR HARNESS.—W. H. Morgan, Alliance, Ohio, assignor to himself and R. B. Geyer, Allegheny, Pa.

107,087.—HARNESS HOOK AND LOOP SHIELD.—W. H. Morgan, Alliance, Ohio, assignor to himself and R. B. Geyer, Allegheny, Pa.

107,088.—PRESERVING BREAD.—J. J. A. Mouries, Phalsbourg, France.

107,089.—SCHOOL REGISTER.—S. S. Nash, New York city.

107,090.—CORN STALK CUTTER.—A. J. Nebergall, Cedar Co., Iowa.

107,091.—MACHINE FOR BORING AND MARKING.—G. M. Nickason, Ellenville, N. Y.

107,092.—SHINGLE MACHINE.—Carl Nordell, New York city.

107,093.—APPARATUS FOR ATTACHING STANDING RIGGING TO MASTS.—James Nute, Boston, Mass.

107,094.—HAND LOOM.—J. E. Nute, Lincoln, Me.

107,095.—FENCE.—T. W. Owens, Granville, Ohio.

107,096.—BOLT FASTENING.—Peter Peterson, Abingdon, Ill.

107,097.—METHOD OF INLAYING WOOD.—T. W. Porter and H. E. Porter, Boston, Mass., assignors to themselves and C. L. Marston.

107,098.—STEAM ENGINE.—Elting Post, Boston, Mass.

107,099.—GUN CARRIAGE.—A. F. Potter, Oakland, Cal. Antedated August 27, 1870.

107,100.—LOCK.—Titus Powers, New York city.

107,101.—ELECTRO-MAGNETIC RAILROAD ALARM.—E. H. Purcell, Galesburg, Ill.

107,102.—COTTON-GIN FEEDER.—Joe Ralston, Brenham, Texas.

107,103.—DRAIN PIPE.—George Richardson, Milwaukee, Wis.

107,104.—CAPSTAN.—J. W. Riggs, Wade, Ohio. Antedated September 1, 1870.

107,105.—APPARATUS FOR LIGHTING GAS BY ELECTRICITY.—R. T. Robbins, Boston, Mass.

107,106.—BRIDGE.—Jacob Seebold, Kautz, Pa.

107,107.—MILK CAN AND COOLER.—Samuel Shattuc, Kipton, Ohio.

107,108.—MOWING MACHINE.—G. F. Shaw, West Roxbury, Mass.

107,109.—TUCK-CREASING ATTACHMENT FOR SEWING MACHINE.—J. J. Sibley, New York city.

107,110.—CORN PLOW AND PLANTER.—Clark Sintz, Clark Co., Ohio.

107,111.—GUANO-DISTRIBUTING MACHINE.—G. W. Sizer and W. M. Owen, New Orleans, La.

107,112.—CARRIAGE AXLE.—A. E. Smith, Bronxville, N. Y.

107,113.—RAILWAY SWITCH.—C. S. Smith, Seneca Falls, N. Y.

107,114.—LOW WATER AND HIGH STEAM INDICATOR.—L. F. Smith, Philadelphia, Pa.

107,115.—SAFETY TRUCK AND CAR BRAKE.—W. C. Smith, New Britain, Pa.

107,116.—COMBINED POWER-PUNCH AND SHEARS.—A. C. Stannard, Milton, Wis.

107,117.—LOCOMOTIVE ASH-PAN.—H. A. Stoddard, Springfield, Mass.

107,118.—HARVESTER CUTTER.—Daniel Stukey, Lancaster, Ohio.

107,119.—BRIDGE GATE.—J. D. Sturges, Chicago, Ill.

107,120.—PROPELLER FOR STEAM VESSELS.—Robert Sutton, Newcastle, Del.

107,121.—NAIL EXTRACTOR.—G. C. Taft, Worcester, Mass.

107,122.—REED ORGAN BELLOWS ACTION.—Simeon Taylor, Brighton, Mass.

107,123.—TRUNK LOCK.—James Terry, Jr., Terryville, Conn.

107,124.—DEVICE TO REGULATE THE FLOW OF SAP TO EVAPORATING PANS.—John Thomas, Hardwick, Vt.

107,125.—DEVICE FOR CUTTING WIRE OR CORD FROM BOTTLE-STOPPERS.—J. A. Traut, New Britain, assignor to himself and J. W. Bliss, Hartford, Conn.

107,126.—BINDING ATTACHMENT FOR HARVESTERS.—D. W. Travis, Enfield, and C. M. Clinton, Ithaca, N. Y.

107,127.—AUTOMATIC GAS REGULATOR.—S. O. Trudell, Detroit, Mich.

107,128.—SHEARING AND CLIPPING APPARATUS.—George Twigg, Birmingham, England.

107,129.—PHOTOGRAPHIC BACKGROUND.—D. W. Van Riper, Columbus, Ga.

107,130.—HAIR ROLL.—J. H. Vogt and George Dietzel, New York city.

107,131.—BEDSTEAD FASTENING.—J. H. Waite (assignor to Rodney Hunt, J. H. Waite, and D. B. Flint), Orange Mass.

107,132.—HEEL CALK.—M. F. Walter and Charles Standinger, Hartford, Conn.

107,133.—WAGON JACK.—J. W. Walton, Decatur, Mich.

107,134.—BREAST-STRAP PROTECTOR FOR HARNESS.—L. R. Ward, Ward's Corners, Iowa.

107,135.—MACHINE FOR GROOVING THE FRAMES OF CHAIR SEATS.—G. A. Watkins, Cavendish, Vt., assignor to the American Chair-Seat Company, Gardner, Mass.

107,136.—CHAIR SEAT.—G. A. Watkins, Cavendish, Vt., assignor to the American Chair-Seat Company, Gardner, Mass.

107,137.—CHAIR SEAT.—G. A. Watkins, Cavendish, Vt., assignor to the American Chair Seat Company, Gardner, Mass.

107,138.—CHURN DASHER.—T. H. Weaver, Marietta, Ga.

107,139.—BUTTER PAIL.—H. P. Westcott, Seneca Falls, N. Y.

107,140.—LANTERN.—William Westlake, Chicago, Ill.

107,141.—OIL CAN.—William Westlake, Chicago, Ill.

107,142.—CULTIVATOR.—C. L. Whaite, Waverly, Pa.

107,143.—SCREW FOR SOLES AND HEELS OF SHOES.—L. H. Whitney, Washington, D. C.

107,144.—GALLEY.—F. M. Wildman, Fairfield, assignor to himself and J. S. Fayerweather, Ridgefield Station, Conn.

107,145.—LOCK.—Horatio Willard and Peter Trunz, Evansville, Ind.

107,146.—DRAWING FRAME.—T. S. Winn, Lawrence, Mass.

107,147.—APPARATUS FOR AND PROCESS OF DISTILLATION.—George S. Williamson, Gallatin, assignor to himself and E. R. McKean, Nashville, Tenn.

107,148.—AUTOMATIC CRADLE.—Darius Alger (assignor to himself and Theodore Barnum), Byron, Mich.

107,149.—RAILROAD CAR HEATER.—Joshua G. Allen, Philadelphia, Pa.

107,150.—METHOD OF INLAYING WOOD, ETC.—J. S. Baldwin (assignor to C. F. Ritchel), Newark, N. J.

107,151.—WASHING MACHINE.—C. S. Banker and Alexander Purdy, Hector, N. Y.

107,152.—WOOD PAVEMENT.—Albert Betteley, Boston, Mass.

107,153.—JEWELERS' TOOL.—D. M. Bissell, Shelburne Falls, Mass.

107,154.—SHOOTING STICK FOR PRINTERS.—B. B. Blackwell, New York city. Antedated Aug. 26, 1870.

107,155.—SOLE-SEWING MACHINE.—Lyman R. Blake, Boston, Mass.

107,156.—CORN PLANTER.—J. L. Bond, Marshalltown, Iowa. Antedated Aug. 27, 1870.

107,157.—SASH HOLDER.—C. S. Bonney, Syracuse, N. Y.

107,158.—MANUFACTURE OF ALBUMEN.—Gustav Burgade, New York city.

107,159.—FLOODGATE.—T. H. Breed, Dundee, Mich.

107,160.—DIE FOR HEADING BOLTS.—Fred'ck Bruso, Buffalo, N. Y.

107,161.—STEAM ENGINE.—D. B. Caldwell (assignor to himself and J. H. McGowan), Cincinnati, Ohio.

107,162.—DITCHING PLOW.—George Chamberlin, Olean, N. Y.

107,163.—DEFLECTOR FOR WINDOW OF RAILROAD CARS.—William Conrad, Burlington, N. J.

107,164.—COFFIN.—J. E. Cox, Cincinnati, Ohio.

107,165.—SIDE LIGHT FOR VESSELS.—Wm. Darley, Chatham, England.

107,166.—ENVELOPE.—B. C. Davis, Binghamton, N. Y. Antedated Aug. 27, 1870.

107,167.—FAN BLOWER FOR SMITHS' FORGES.—Lindsay Duskin and Benjamin Sledge, Thomasville, N. C.; said Duskin assigns his right to Wm. Dickson and J. D. Delap, same place.

107,168.—LOOM TEMPLE.—W. W. Dutcher (assignor to the Dutcher Temple Co.), Hopedale, Mass.

107,169.—MACHINE FOR WASHING AND SCREENING ORES AND FERTILIZERS.—Alfred Duvall, Baltimore, Md. Antedated Aug. 26, 1870.

107,170.—AXLE BOX FOR CARRIAGES.—L. R. Dye, Cranberry, N. J.

107,171.—WIRE CLOTH FOR COAL SCREENS.—J. G. Frick, Pottsville, Pa.

107,172.—PRUNING TOOL.—Samuel Gamwell, Wayland, Mich.

107,173.—SPRING CARRIAGE.—Demon R. Gould and Warren S. Hickham (assignors to themselves and N. B. Mallory), Chestertown, N. Y.

107,174.—PERMUTATION LOCK.—Henry Gross and J. L. Hall, Cincinnati, Ohio.

107,175.—WHIP HOLDER.—Nelson Hanchett, Leslie, Mich.

107,176.—LOCK FOR SECURING STAMPS UPON BARRELS.—J. L. Harley, Baltimore, Md.

107,177.—TANNING LEATHER.—Clarence L. Jenkins, Omaha, Nebraska.

107,178.—WATER CLOSET.—John Keane, New York city.

107,179.—MACHINE FOR SHEARING METAL.—A. A. Kent, Lyons, Iowa.

107,180.—REFRIGERATOR AND SIDEBOARD.—W. H. Kern and T. M. Davis, Philadelphia, Pa.

107,181.—STEAM GENERATOR.—John C. Kilgore, Philadelphia, Pa.

107,182.—BALANCE.—G. W. King, Georgetown, D. C.

107,183.—HORSE HAY RAKE.—Gasoway O. Lackey, Akron, Ohio.

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107,205.—CLOTH-MEASURING MACHINE.—Thomas Weedan and Thomas Tribe, Hillsdale, Mich.

107,206.—STEAM AND VAPOR ENGINE.—F. A. Morley, Syracuse, N. Y.

107,207.—COMBINED LOCK AND LATCH.—S. C. Weddington, Jonesborough, Ind.

107,208.—APPARATUS FOR THE MANUFACTURE OF ILLUMINATING GAS.—H. G. Ludlow, Troy, N. Y.

REISSUES.

4,114.—ATTACHING KNOBS TO SPINDLES.—Matthew Andrew, Melbourne, Victoria. Patent No. 101,868, dated April 12, 1870.

4,115.—WEIGHT FOR SASHES, CLOCKS, ETC.—D. B. Lacy, Mott Haven, N. Y., Isaac A. Lacy, Saugerties, N. Y., Thomas T. Lacy, Jersey City, N. J., the Lacy Sash Weight Co., and the Standard Sash Weight Co., New York city, assignees, by mesne assignments, of D. B. Lacy.—Patent No. 50,171, dated Sept. 18, 1865.

4,116.—CARRIAGE WHEEL.—J. D. Sarven, New Haven, Conn. Patent No. 17,530, dated June 9, 1857; reissue No. 3,979, dated August 11, 1868.

DESIGNS.

4,324 to 4,333.—CARPET PATTERN.—Robert R. Campbell (assignor to Lowell Manufacturing Company), Lowell, Mass. Ten Patents.

4,334.—KNITTED FABRIC.—Thomas Dolan, Philadelphia, Pa.

4,335.—CUPBOARD LATCH.—William Gorman (assignor to the Russell & Erwin Manufacturing Co.), New Britain, Conn.

4,336.—COLLAR BOX.—S. F. Hilton, Providence, R. I.

4,337.—NET FABRIC.—R. H. Jefford (assignor to A. G. Jennings), New York city.

4,338.—CLOCK CASE.—S. B. Jerome (assignor to Samuel Peck & Co.), New Haven, Conn.

4,339 to 4,343.—CARPET PATTERN.—Elemir J. Ney, Dracut, assignor to Lowell Manufacturing Company, Lowell, Mass. Five Patents.

4,344.—FLOOR OIL CLOTH.—John T. Webster, New York city and Albert E. Powers, Lansingburg, assignors to Deborah Powers, A. E. Powers, and N. B. Powers, Lansingburg, N. Y.

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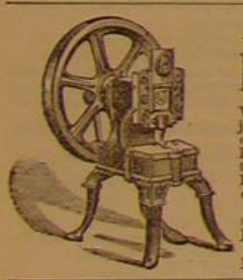

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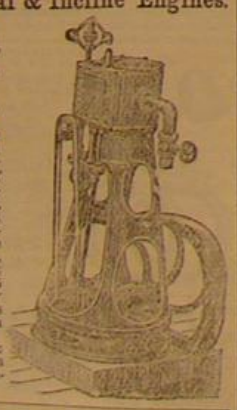

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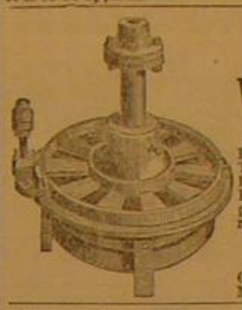

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