SCIENTIFIC AMERICAN

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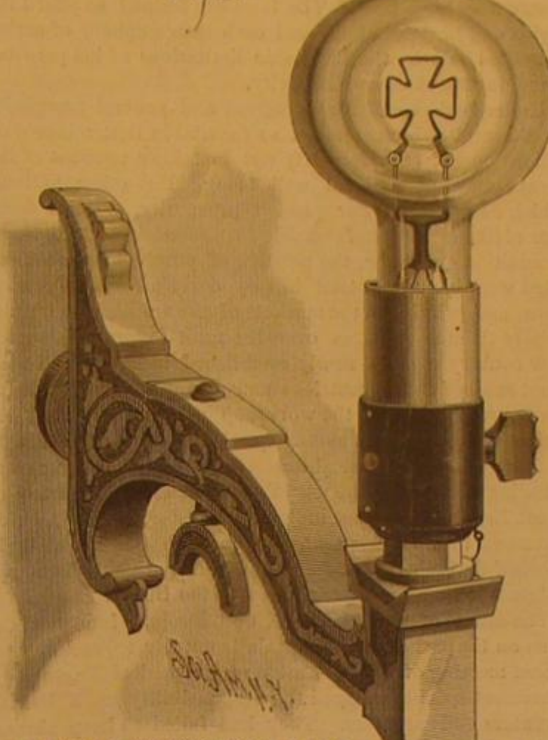
RECENT DEVELOPMENTS IN ELECTRIC LIGHTING.

That the electric arc light has been gaining in public favor is evidenced by its permanent adoption in a large number of public halls, theaters, factories, warehouses and stores throughout the country; and its application to tunnels, mines, and engineering work by night, and to out-of-door illumination in streets, parks, and public places. It is also employed for lighting docks, and to a considerable extent by traveling shows. In its application to lighthouses and head-lights of steamers it certainly has no rival.

One of our prominent mechanical engineers, Mr. H. S. Maxim, of this city, has long been engaged in perfecting the electric light in its various forms, and has been one of the foremost in adapting it to special purposes. His dynamo-electric machines and electric light projectors for land and marine uses have been already illustrated in this journal, and not long since we published engravings of a new focusing lamp by the same inventor. We now give engravings of a new and remarkably efficient current regulator for electric light circuits, and illustrate a dynamo-electric machine, which is probably the largest ever built in this country. We also furnish views of Mr. Maxim's incandescent lamp which is now brought to public notice for the first time, although, as we are informed by the inventor, the lamp was made substantially in its present form some three or four years since. In fact, Mr. Maxim claims to be the pioneer in this direction.*

* The application for a patent on Mr. Maxim's incandescent lamp was filed October 4. 1878; the patent was granted August 10, 1880. The process of manufacturing carbon was patented July 20, 1880. The dynamo machine was patented June 8, 1880. The machine for regulating the current was patented June 8, 1880. A process for charging the lamps with vapors of gasoline was patented August 10, 1880.

Fig. 4.



MAXIM'S INCANDESCENT LAMP.

The current regulator, which is shown in perspective in Fig. 1 and side view in Fig. 2, controls the current perfectly, and proportionates it so accurately to the work to be done that it makes no difference whether there are fifty lamps in the circuit or only one, the current in the single lamp when used alone being the same as it is when the lamp is associated with forty-nine others in the same circuit.

The manner in which this wonderful result is secured will be apparent on studying Figs. 1 and 2. In an electric lighting station, where a number of large machines like that shown in Fig. 3 are used, the field magnet of each machine will be excited by a small dynamo machine like that shown in connection with the current regulator in Figs. 1 and 2, and the strength of the current generated by the large machine depends on the degree of excitation of its magnets. If a strong current is desired the field magnets are strongly magnetized by their inclosing helixes. If a very weak current is desired the magnets are but slightly excited, and the strength of the current may vary anywhere between these two extremes.

The commutator brushes of the exciting machine are arranged to swing on a bearing concentric with the commutator cylinder, so that by turning the brushes around to the neutral points the current is nil, and by turning it back nearly to the central position between the neutral points the current is the strongest that can be obtained from the machine. The current regulator is influenced by the current proceeding from the large machine and controls the mechanism which moves the commutator brush of the small machine, in this manner regulating the excitation of the mag-

[Continued on page 262.]

Fig. 1

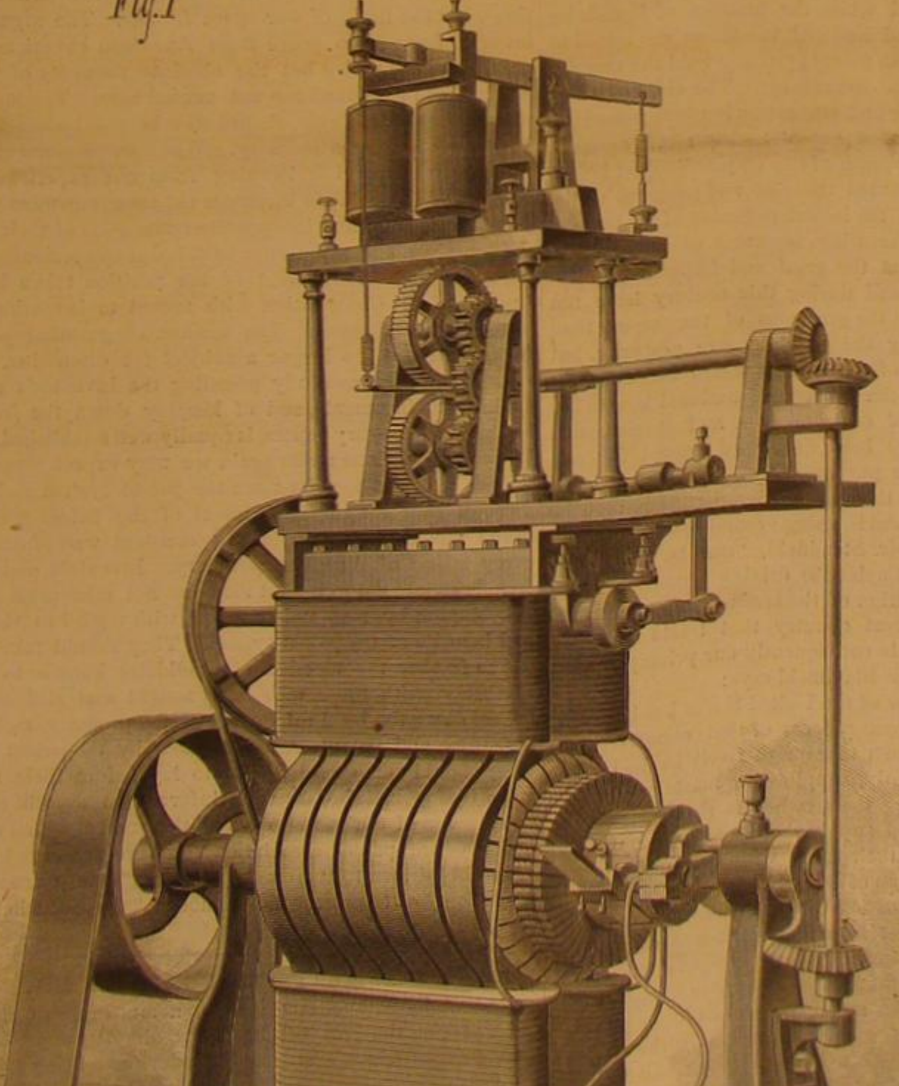
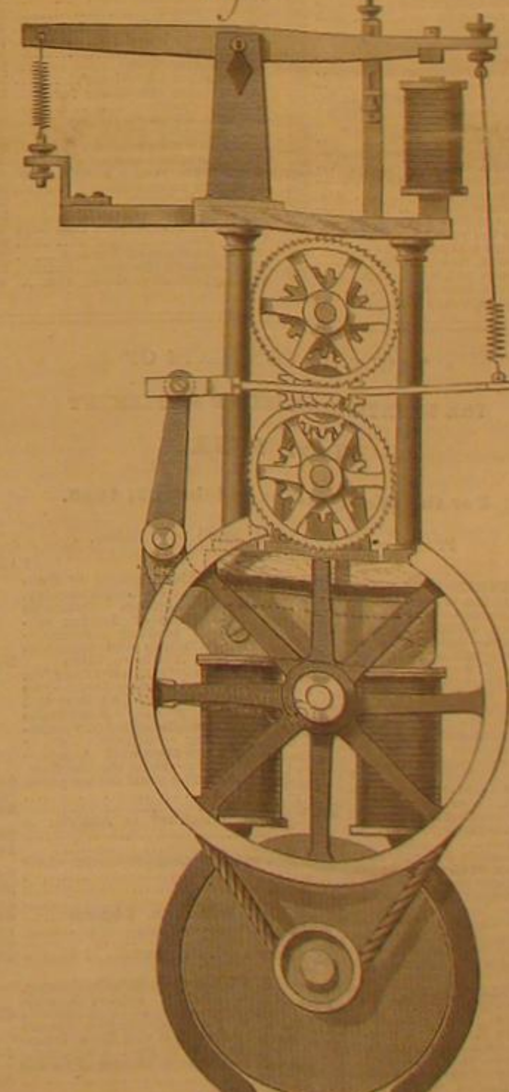


Fig. 2.



MAXIM'S CURRENT REGULATOR.

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NEW YORK, SATURDAY, OCTOBER 23, 1880.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 251,

For the Week ending October 23, 1880.

Price 10 cents. For sale by all newsdealers.

THE RELATIONS OF CHEAP PATENTS TO INDUSTRIAL PROSPERITY.

The factors of American prosperity are many.

We have a magnificent country, to begin with; a territory of continental scope, made fruitful by a climate unsurpassed in kindly adaptation to needs of varied agriculture and the requirements of industrial activity. Our mineral resources are unrivaled in richness and variety. Our complex population embodies no small part of the best pluck and energy and intelligence of all civilized nations. Our free institutions favor individual and associated activity in all legitimate directions. With us men are respected as men and honored according to their deeds; the thoughtful laborer, whose practical sense or constructive ability adds new force or utility or convenience to the common possessions, far outranks in popular estimation the thoughtless inheritor of wealth or social position, however honored or useful his ancestry may have been. The laws are framed to guard the rights and liberties of all; and each man's sphere of action is limited only by the inevitable limitations of his personal force, intelligence, and integrity.

Under such conditions progress and general prosperity would seem to be inevitable, so inevitable that minor conditions might be safely left out in taking account of the great factors of national well being. But other nations, which do not share our present prosperity, are not destitute of like conditions favorable to industrial success. Some in addition enjoy age, the prestige of power, long accumulated wealth, an industrial history covering many generations, and priority in the markets of the world, which unite to give them advantages over the most favorably situated new country with its newly established industries. In the front rank of such countries stands Great Britain, which for many years has been the workshop of the world, and still retains a commercial supremacy which tells immeasurably in favor of her mechanical industries, in giving them a commanding position in the world's markets. Yet the trade of Great Britain languishes under a serious depression, which threatens to become permanent through the increasingly successful rivalry of other industrial nations—Germany, Belgium, France, and pre-eminently the United States.

The causes of this relative if not absolute industrial decline on the part of Great Britain is not far to seek. At a recent meeting of the Institution of Mechanical Engineers a prominent speaker charged the responsibility upon British inventors and engineers. They had failed to keep abreast of the times. They had allowed the inventors of other countries to displace their products even in British markets. The question was taken up at the August meeting of the London Association, and while the inaction of British inventors was admitted and deplored, the blame was traced to the working of the British patent system. Said the essayist of the occasion, Mr. John Standfield: "The chief cause of our commercial suffering and stagnation is a barbarous law, which to a very great extent prohibits science from developing the resources and strength of the empire." Just before Mr. Standfield had attributed the rise and progress of the British empire wholly to the inventive genius of its people, coupled with the manufacturing resources of the country, pointing out the fact that the great and important inventions patented in England during this century have not only contributed more to the greatness of the empire than all that was done during the previous five centuries, but have brought nearly all of the wealth which England now possesses. Even where the sources of national wealth lay underground, in mines of coal and iron and copper, such wealth could never have been developed except for machinery invented for the purpose. But invention is now less active in England than in France, Belgium, and the United States, and England is losing ground in consequence. This loss of trade, says Mr. Standfield, "may be directly attributed to our (*i. e.*, England's) driving abroad or suppressing a very large portion of the seeds of our prosperity. America is the only great country that treats practical science fairly, and she is consequently our principal competitor." Further on Mr. Standfield says:

"The cheap patent law of the United States has been and still is the secret of the great success of that country. . . . The invention we suppress takes root freely in the United States, which, consequently, supplies our marts with large quantities of labor-saving tools, whereas if our laws were fair and equal we should supply their marts, and use the proceeds for purchasing their grain without impoverishing our country by a great loss of capital as at present."

In the subsequent discussion this point was dwelt upon at great length. How can it be expected, it was asked, that English engineers and inventors can compete with their brethren in the United States when the American can get twenty-five patents for the money which has to be paid for one in England? Very few inventors can pay the fees demanded by the English Patent Office. "The result is," said one speaker, "one-third of our inventors are driven to America, and another third are buried, the secret of their invention still with them." And this obviously covers but a part of the national loss, since the possible but never-to-be developed inventors in English workshops probably outnumber many times the actual inventors who undertake to put their ideas into working shape. This was put very clearly by one of the speakers. "He had heard it said in every quarter of the globe that English workmen had little or no inventive genius, although they improved things very well, but upon examination he said it would be found that the names to most of the American patents were English names; and he felt certain that, if the cost of a patent in England were the same as in America, instead of 5,000 patents, the English should take out 45,000 to the Americans' 30,000. If placed on the same footing as the United States, a great impetus to trade would follow. It was evident that there was something wrong when America could pay £9 where England paid £6 per ton of iron, and 9s. instead of 6s. per day for labor, and yet beat the English in the open market. He thought it was the duty of the Board of Trade, when the country was losing its trade, to inquire as to the cause of it. There was only one reason for it, and that was the abundance of labor-saving tools used by the Americans, because their mechanics could get all their appliances protected so cheaply."

In the course of his remarks the essayist pointed out that by suppressing native genius through heavy patent fees, England had driven away many national industries in which she had once held a foremost place. The pianoforte trade was one, London being rapidly stocked with instruments made in New York. The watch and silk trades had been driven out of Coventry and Clerkenwell, while machine-made watches were being developed in America, where labor was 50 per cent dearer. Said the speaker: "The American cheap patents and labor-saving tools alone account for Coventry's and Clerkenwell's misery and decay, and for England's serious loss of revenue and national income. If our workmen were allowed to become inventors they would prove quite as well able to design and manufacture machinery for the construction of cheap watches as the Americans. On the present system our best mechanics, if they have any ambition, are compelled to emigrate to America, where alone they can find an opportunity of utilizing their genius."

Further on the speaker said: "The American patent laws have given the inventors of such small but generally useful articles as sewing machines such a good opportunity of universally introducing their inventions that it is now not worth the while of any manufacturer here or elsewhere to attempt to compete with the American houses. There are 4,000 skilled artisans employed in the United States in this small manufacture alone. While American organs of numerous descriptions are not only excellent but cheap, there is not a single cheap English organ known to the public.

"What has occurred to our piano and watch trade is now occurring—if it has not already occurred—in regard to the manufacture of locomotives and many other manufactures, to the partial ruin of our trade, wealth, and empire."

We might continue these forcible and instructive citations, but the limit of our space forbids. The arguments brought forward to prove from American experience not only the sound policy but the absolute necessity of lower patent fees in England are not needed here. The moral of the discussion, however, should not be overlooked by the friends of American industry. While our greatest rival in the industrial world is learning from our experience the wisdom of extending to inventors the encouragement which comes from a just and inexpensive recognition of their rights the American people must not be deluded by specious sophistries into an abandonment of the position taken by the framers of our Constitution with regard to inventions and letters patent therefor. The wisdom of granting patents for invention is no longer a subject for discussion. The sound policy of carefully guarding the inventor's rights, against infringements, and of keeping down the fees for issuing the necessary papers, is equally well established. Yet as soon as Congress meets again we may expect a puzzling variety of covert assaults upon the patent system under the guise of bills for the amendment of the patent laws—assaults which will demand the constant watchfulness of every friend of American industry. Inventors and their friends should see to it that they are not misrepresented at Washington by men uninstructed with regard to the uses and benefits of the patent system. They should take pains not to further the election of candidates known to be in sympathy with those who have sought and still seek to break down the legal safeguards of the property rights of inventors and patentees, as provided by the patent laws. They should take especial pains to lay before their representatives in both houses such information as will enable the framers of our laws to avoid the snares which clever agents of anti-patent associations are sure to weave in bills ostensibly drawn to "promote industry" and "encourage invention," or to protect the "innocent" users of what does not belong to them.

"MALARIAL" FEVER IN NEW ENGLAND.

Undoubtedly "malaria" covers a multitude of sins of ignorance on the part of physicians, almost every malady, the nature of which is not readily understood, being attributed in professional parlance to malaria or malarial complication. Still there is evidently some malefic influence, whether in the air, in the earth, or in the waters under the earth, that has been causing in New England the past summer almost as much suffering as the break bone fever has occasioned along our Southern coasts.

The history of the "malarial wave," as it is called, and its progress eastward and northward, is instructive. For forty years preceding 1865 New England had been practically exempt from the troublesome "chills and fever," "fever and ague," or "malarial fever," which prevailed more or less generally further West and South. There had been an epidemic of it after the war of 1812, and an earlier wave had passed over the country after the war of the Revolution. As in the earlier instance, so in the later civil war, the return of afflicted soldiers from malarial regions was followed by a slowly developing malarial epidemic. The first cases among the stay-at-homes appeared along the railway traversing the shore of Long Island Sound. Gradually it spread into the interior, most rapidly along lines of public works. The upturning of new soil was supposed to cause the extension of the plague, though the same sort of work during the preceding forty years had never been followed by such results. It will be remembered that just after the war was a period of public improvement; in every thriving town streets were laid out and graded; public waterworks were introduced, and gas pipes were laid down in many villages—all requiring the employment of large gangs of laborers, recruited largely from the ranks of lately returned soldiers. It seems to us altogether more likely that the germs of the succeeding epidemic of "malarial" fever were imported by men who had taken the disease while on duty in the malarial regions of the South and West, than that they were developed or brought to the surface by the displacement of raw earth.

Very probably the interference with lines of natural drainage, incident to the construction of railways, waterworks, and the like, and the ponds and ditches left where earth had been taken out for embankments and roadways, furnished many appropriate places for the multiplication of the imported malarial germs. At any rate the progress of the epidemic was largely governed, if it was not hastened, by the progress of such works. Once widely prevalent, as it became in the course of four or five years along the main line of railway towns near the Sound, the natural movement of population sufficed to carry the epidemic into the interior.

Its progress up the Connecticut and other rivers and along lines of railway communication was traceable year by year, until there came a season, like the past summer, when the climatic conditions seem to have been specially favorable to the spread of the malady, and it became exceedingly prevalent, both as a distinct disease and an element complicating the symptoms of other diseases.

In the early part of the season the State Board of Health of Massachusetts undertook to investigate the subject, and has collected a mass of evidence which can hardly fail to throw a clearer light upon the nature and conditions of the epidemic. From reports in local papers it is clear that the troubles attributed to malaria have prevailed to an alarming extent, particularly along the Connecticut valley. Cases have appeared in every town from Connecticut to Vermont; and in Springfield, Holyoke, and other large places the number of cases has been very great. Heretofore this region has been not only a healthy one, but exceptionally free from troubles of this nature. In the Housatonic valley, in southwestern Massachusetts, around Barrington, for example, hitherto one of the healthiest districts in all the land, the malarial epidemic has been the severest ever known in New England. The disease is described by the visiting physician of the Board of Health as a genuine intermittent fever, many of the cases being very severe. The disease has attacked all classes of persons, some living at considerable distances from supposed malarial centers, and it counts its victims among the old, the middle aged, and the young, among new residents, old residents, and casual visitors.

The manner in which the epidemic sweeps through regions previously proverbial for their salubrity, seems to show that the disease is not of local origin and cannot be "in the air."

Before the results obtained by the inquiries of the Board of Health are compiled and digested, any opinion as to the actual propagation of the epidemic can be little better than a guess; nevertheless it may be safe to express the strong suspicion that wells and water courses, tainted by the fecal discharges of victims of the disease in one form or another, are more likely to prove the distributers of the poison than cold winds, night air, emanations from swamps, or any other purely aerial or malarial agency.

THE REVIVAL OF AMERICAN COMMERCE.

A commercial convention, called by the New York Board of Trade and Transportation, met in Boston, October 6, fifty-one important mercantile associations being represented. The chief subject proposed for consideration was the revision of the navigation laws under which the supremacy of our country in its own carrying trade has been lost. In 1855 American vessels carried $405,000,000, and foreign vessels $131,000,000 of our exports and imports. In 1879 foreign vessels took $911,000,000, and American vessels only $272,000,000. The greater part of our merchant marine is now engaged in the coasting trade, while its aggregate tonnage is more than a million tons less than it was twenty-five years ago.

The great question is, How are we to recover our commercial standing among commercial nations? At this writing but one session of the convention has been held. The problems which the delegates have in hand are of national magnitude, and of the most far-reaching importance. It is devoutly to be hoped that whatever decision they may arrive at may be such as will hasten the restoration of our mercantile marine to the honorable position it held before the war. During the past twenty-five years our mechanical industries have been pushed to the front rank among those of industrial nations. The next twenty-five years should see as marked an advance toward American commercial supremacy.

BENJAMIN PEIRCE.

In the death of Professor Benjamin Peirce, October 6, in the forty-seventh year of his professorship at Harvard College, America loses one of its ablest mathematicians and scientific men. Prof. Peirce was born in Salem, Mass., in 1809. He was graduated at Harvard in 1829; became tutor in 1831, University Professor of Mathematics and Natural Philosophy in 1833, and Perkins Professor of Astronomy and Mathematics in 1842. Between 1836 and 1846 he published a series of mathematical text-books, which, though never widely adopted in schools, have had a marked influence upon the mathematical teaching of this country. The founding of the observatory at Harvard was brought about by his lectures on the comet of 1843. His investigations in connection with the discovery of Neptune in 1846 made his name known and honored the world over. In 1849 he was appointed Consulting Astronomer to the "American Ephermis and Nautical Almanac," for which he prepared a volume of lunar tables in 1852. The results of his labors on Saturn's rings were published between 1851 and 1855. His valuable services in connection with the United States Coast Survey led to his appointment as superintendent of that important work in 1867, an office which he held until 1874.

His "Treatise on Analytical Mechanics" appeared in 1857, and in 1870 was published an edition of 100 lithographed copies of "Linear Associative Algebra," a work remarkable for the power and boldness of its reasoning. More recently he delivered a course of Lowell lectures on "Ideality in Science," in the course of which he made the remarkable statement of problems of cosmical physics printed in this paper about a year ago.

FIREPROOF FERRYBOATS.

The repeated demands of the public for the use of fireproof material in building passenger steamers for inland navigation seem likely at last to be complied with. A company has been formed with a capital of $10,000,000, to build excursion steamers for use in the waters around New York. They are to be not only indestructible by fire, but also impossible to sink. The use of fireproof material for the upper works and water-tight compartments in the hulls should be made compulsory in the construction of all new steamers carrying passengers on the inland waters of the country. In view of the fearful accidents that have happened ever since steam navigation became general, it is strange that such conditions have not long since been required of our shipbuilders; but evidently this greatly-needed reform will be brought about by the operation of that much-abused doctrine, the "survival of the fittest;" for if the public is offered a choice between a floating fire-trap, liable to be sunk like an egg shell, and an equally elegant but fireproof and non-sinkable craft, the fire-trap will soon cease running for lack of patronage.

But the excursion steamers are not the only vessels for which these reforms are urgently demanded. The ferryboats plying in the North and East Rivers, sometimes carrying more than a thousand passengers at a trip, are equally important subjects for radical treatment. It is true that there have been few serious accidents attended with large loss of life on these craft; but the possibility, yes, the extreme probability of such accidents, cannot fail to strike any one; built of light wood, thickly painted, oiled, or varnished, they would burn with great rapidity even with little draught; but when it is remembered that they are so built as to create the strongest kind of a draught throughout their whole length, it will be seen that within 20 minutes of an outbreak of a fire, there would be nothing left to burn. The greater part of the passengers would be burned or drowned, and there would be only a small number saved under favorable conditions; but if, for example, the fire started while the boat was in a pack of heavy ice midway in the river, there would be hardly a score escape alive. Such an accident happened on a Philadelphia and Camden ferryboat several years ago, but by great good luck the fire broke out on an early trip in the morning, when very few persons were on board, so that the loss of life was small.

Even a false alarm of fire would cause many deaths, since the panic that would result on board a ferryboat of the present style would drive a large number overboard. Some would voluntarily spring into the water to escape death by burning, while others would be forced over the side in the struggle of those in the center to get out.

All these dangers would be avoided if every passenger knew that the boat could neither burn nor sink; under such circumstances the cry of "fire" would produce no panic, and even in the most serious collision the passengers would know that there was no danger after the first shock. For these reasons it is evident that the proposed reforms in excursion steamers should be hastened into effect upon the lines of ferryboats also. But it is here that they will be slowest to make their way. The ferry routes are monopolies; their proprietors fear no competition such as threatens the owners of excursion steamers; they have large amounts invested in their present craft, and they will not voluntarily abandon these boats and go to great expense for others unless compelled to do so. If resort be had to Congress or the State Legislature to compel the needed change by statute, the companies have both money and influence enough to delay long, if not wholly to prevent, the passage of the requisite laws; consequently they can be reached only through their pockets or through the influence of an overwhelming public opinion. As before stated, they are independent of competition, and therefore it is difficult to touch their pockets; hence public opinion alone is likely to bring about the desired change. Now, if they are called upon to abandon their present boats and build others of far more expensive types, they will stand a great deal of pressure from that indefinable force known as public opinion before they will yield—the great loss and expense involved will have the greater weight; but if any one can devise a plan by which their present fleet of steamers can be rendered fireproof and non sinkable for a moderate outlay, there is little reason to doubt that they would be apt to regard such an improvement favorably. For example, the light woodwork of these boats has one advantage over iron; it will float if detached from the hull containing the boilers, engine, etc. Hence, if it can be rendered fireproof, the problem is solved at once. All that will be necessary will be to have all that portion containing the cabins, roadways, etc., detached from the hull, so that, no matter what might happen, the most important portion would readily float with all the passengers. Panics could be averted by numerous signs: "This boat can neither burn nor sink." The hull of the ferryboat should extend to the guards, which should project, as at present, beyond the upper works. These latter could be removed, made fireproof, and replaced at no great cost. The upper portion should then be built upon a heavy flooring, which should be wholly detached from the hull. To prevent displacement of one upon the other, vertical bolts should be used which would keep the two parts in position, but offer no resistance to a separation on account of a downward strain. The shafts, wheels, and walking-beam should be so arranged as not to have any connection whatever with the upper works, and in case anything should happen to cause the hull to sink, it would go to the bottom, and leave the great box containing the passengers floating on the surface.

The inventor who can render wood fireproof without seriously impairing its buoyancy, will have not only the ferryboats, but the whole fleet of wooden passenger steamers, to remodel. If the new company successfully carries out its present programme, the old craft must conform to the new condition of absolute safety or go out of business. There is no more profitable field open for an inventor than a solution of the problem: How can a wooden steamer be rendered fireproof and non-sinkable at the least cost?

DESIGNS PRODUCED BY CRYSTALLIZATION.

A French inventor noticed the manner in which watery vapor in a warm room congeals against the glass during frosty weather and forms needle-like crystals, interlacing one another like the threads of a tissue. This observation gave him the idea of producing designs for textile fabrics by crystallizing various salt solutions on a sheet of clay. He first tried the sulphates of copper, zinc, iron, alumina, and magnesia. He covered five clean glass plates, each with the solution of one of these salts, placed them in a horizontal position, and allowed them to crystallize slowly by evaporation. He found further that the crystal form became more suited for his purpose when he added albumen, gum, starch, or gelatine to the solution, while at the same time the crystals became more resistant. He found also that different temperatures influenced the forms of the crystals, and that he could produce fantastic trees, flowers, stars, arabesques, roots, and even insects of interesting design. He went through many experiments, and ended by making the figures obtained permanent by electrotyping, for which purpose he caused the solutions to crystallize upon strong plates of copper or German silver. A clean sheet of lead, placed on the finished crystallization, gave, by hydraulic pressure, a metallic counterpart of the same. Or he used sheets of softened gutta percha, which received the impression and could be used in making a copper deposit in the electric bath.

The great problem, however, was to produce a continuous design which would fit around the rollers with which the patterns are printed on woven fabrics. The detached productions of the crystallization on his plates did not satisfy this condition. He substituted, therefore, in place of his flat plates, metallic cylinders similar to those used for producing the rollers for calico printing. By slowly turning them around their axis, while the solution on their surface evaporated, he obtained a design which satisfied the wants of the printer and the weaver for a continuous design without break in the whole length of the cloth.

There are, however, some objections left. The crystallization is capricious and not sufficiently even and uniform, often leaving blanks which are larger than are agreeable to the purchaser of the fabric; but this may be overcome by experience and precaution. Another objection, however, appears impossible to correct. The two sides of the patterns do not match when different widths are joined at the selvedge of the cloth. It is argued that this is of minor importance, as generally dressmakers and tailors pay no attention to it.

Jacob Boll.

Prof. Jacob Boll, of Dallas, Texas, died September 29, while engaged in scientific exploration in Wilbarge County, of that State. Prof. Boll was a Swiss naturalist and geologist, a favorite pupil of Agassiz, and a man of distinguished scientific reputation. His name is honored in the Harvard Academy of Science, in Philadelphia, Paris, Geneva, Berlin, Zurich, and other seats of learning in Europe. In Texas, in the absence of a State geologist, for six years past his labors have been of great value to science and to the State.

HINTS TO THE YOUNG STEAM FITTER.

BY WILLIAM J. BALDWIN.

DRYING BY STEAM.

Three-fourths of all the manufacturing businesses outside of the metal trades, and many of them, use heat for drying purposes; and as various as are the businesses so also are the modes of drying, often the result of years of experiment.

No manufacturer of wooden articles can get along without a *drying kiln*. The laundry man or woman, the dyer, the hatter, the tobacconist, the piano and organ maker, the dried fruit manufacturer, the japanner, the tanner, all must have a means of drying faster and more conveniently than can be had by exposure out of doors.

Usually steam is used in drying rooms and drying kilns because of its cleanliness, its even distribution, its safety from fire, its easy and quick management, and the cheapness of its maintenance.

The higher the temperature of a drying room the cheaper can the articles be dried. This may not appear plain at first to those who have studied the laws of equivalents, but nevertheless it is so, being caused by local conditions, which always prevent the utilization of all the heat. Thus, the greater the difference in temperature and the slower the movement of the air compatible with the amount of moisture to be carried off, the better the result in the laundry or dry kiln, or any place where rapid drying only is the object.

In no other place is the power of *radiant heat* (direct radiation) more manifest than in the drying room, and more failures can be traced to placing coils under skeleton floors, or flat on the floor, than any other cause, except, perhaps, an ignorance of the principles of piping, which so many consider can be done by any one who wears a pair of greasy overalls.

I have proved in many cases that the same amount of pipe or plate surface, distributed around and between the materials to be dried, will do the work in half the time it takes the heated air from an indirect coil to do it. This is no mistake; and further, wooden blocks can be dried lighter (proving there is more water driven off) by direct radiation than by indirect radiation, the *times* and *temperatures* being the same.

According to the above it is plain that in the construction of drying houses for most purposes the heating surfaces should be so placed and distributed that the direct *heat rays* from the iron could fall uninterrupted on the greatest surface possible of the materials to be dried.

Fig. 1 shows a perspective of a good arrangement of a *direct radiation laundry drying room coil*, utilizing all the radiant heat that is thrown off, and giving a thoroughly uniform heat throughout the room. A A′ are *headers* (often called manifolds), usually made of extra heavy pipe, to admit of tapping and threading, instead of using T's, the cost of the heavy pipe and the drilling and tapping being very much less as well as better and straighter than a header composed of many short pieces of large pipe and the necessary T's. (These remarks apply to all large coils.)

B B are the *spring pieces*, threaded right and left handed; C C, the *leaves* or *sections* of the coil; and D D, the *coil stands*. The stands are always in pairs, to admit of giving the necessary division and inclination to the pipes, and when viewed through the holes look like Fig. 2. The dotted lines are the centers of imaginary pipes to show the pitch. When coils are very wide in the direction of the length of the headers it is well to keep the coil stand 2 or 3 feet from the header at that end, to prevent the expansion from pulling the screws from the floor.

The distance between the holes in the standing coil header is usually about 12 inches, or as wide as the clothes-horses are from center to center.

The usual way to build these coils is to start at the bottom header, A′, Fig. 1, and to put each leaf, C, together continuously, working upward until you reach the elbow, E; then, when all the leaves are so far constructed, with all the elbows looking up, with their left-handed thread uppermost, *count in* and *mark* the right and left handed spring pieces, B, then apply the upper header, A, and screw the whole up as nearly alike as possible.

Do not be persuaded to do away with the spring pieces and the elbows through economy, so as to connect the upper headers straight, as in a box coil; if you do you will have trouble should you want to take down a single leaf for repairs.

Fig. 3 shows sectional perspective view through a laundry drying room, *a* being the coil, *b* the clothes horse, *c* the suspended rail from which the horses hang, *d* fresh air inlet duct, *e* its damper or regulator, *f* ventilator with regulator, usually governed by a cord and bell crank, and drawn back by a spring; and *g* the space into which the horses are drawn, which of necessity must be as long as the horses.

This style of drying room gives the direct radiation of both sides of the leaf of the coil to the fabrics to be dried, and also exposes both sides of a fabric to the direct radiation of a section or leaf.

For high pressure steam 1 inch pipe is generally used in the coil; but if exhaust steam is to be used the pipes should be no smaller than 1¼ inch, and the total length of any one leaf should not exceed 40 feet under a *back pressure* of 2 pounds at the engine.

For exhaust steam the upper header should be large, 3 inches for 12 leaves of 40 feet each, or about 500 feet in the coil, giving good results, to be increased in proportion to the increase in leaves, a 4 inch pipe header being enough for a coil of from 900 to 1,000 feet, composed of leaves of 40 feet each.

Unless the exhaust steam is carried a long distance horizontally, 50 feet or more, the pipe leading to the header may be one or two sizes smaller than the header, provided it is large enough for the engine.

With steam of high tension, small pipe headers with T fittings may be used; but where the pressure is variable, a large header insures an equal distribution of steam to all the leaves.

Sometimes *gridiron* or *floor* coils are used on account of being cheaper, but the same amount of pipe in this form will not dry clothes as fast as the *standing section coil*.

Figs. 4 and 5 show gridiron coils of easy construction, *a a* being the manifolds or headers, *b b* right and left elbows, *c c* coil pipes right handed, and *d d* right and left handed spring pieces.

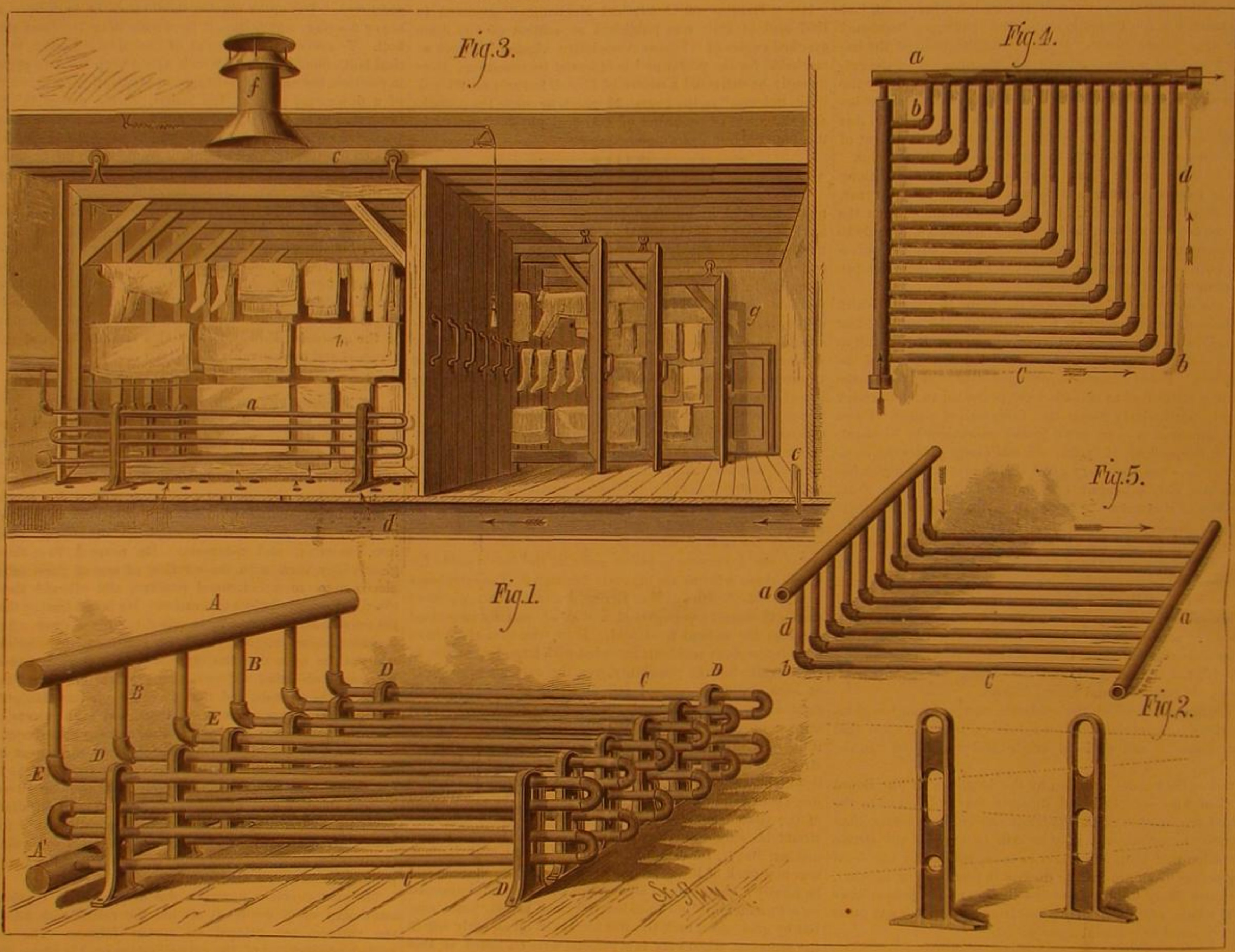
In Fig. 4 the pitch of the pipes and headers are in the direction of the arrows.

These coils are often used in lumber dry kilns, but the same amount of pipe arranged around the walls in miter or wall coils will give much the better result, and will not be a receptacle for dirt, as a floor coil is, which must have a skeleton floor over it to walk over and pile the lumber on.

In large dry kilns on the direct radiation principle, where pipe enough cannot be put on the walls, and for the better distribution of the heat, rows of stancheons should be put up to hang the coils on, in such a manner as not to interfere with the gangways.

The tobacconist prefers to dry without artificial heat, in a temperature of about 60°, with a rapid change of air through the windows. This appears to give dryness without brittleness, but at night and in damp weather they must close the windows, and to get their stock out in time recourse must be had to steam coils.

In experimenting for a well known tobacco manufacturer in fine cut, I found that radiators or box coils placed in the middle of the rooms gave the best result. Wall coils under the windows made the room warm, but did not dry quick, and the tobacco felt wet when brought into a cold room and allowed to remain for a short time. A strong ventilation with a temperature of 80° made it too crisp; but the



ARRANGEMENT OF PIPES FOR DRYING BY STEAM.

box coils placed in the middle of the rooms, with a temperature of 65°, with a small ventilation, with the currents of air in the room up at the center and down at the windows (contrary to the general principle of warming for comfort) gave a result which was declared good.

In piano-case manufactories, and where specialties in glued and veneered furniture of the best quality are made, the workmen are generally supplied with a drying cabinet of a size suitable to the pieces to be done, in which the work is heated before the glue is applied, and into which it is again placed to properly dry.

These cabinets are usually rectangular boxes, with holes in the bottom and top, to allow the air from the room to circulate through them so as to carry off the moisture. Their steam coils are usually of the gridiron pattern, flat on the bottom of the box, with the valves on the outside. Sometimes they are heated indirectly with the warmed air conveyed in tin pipes from a large coil placed in some favorable position.

Some manufacturers claim the quicker the work can be dried after gluing the better it will be.

It is not profitable to dry by forcing air, as with a fan or blower, in connection with a steam coil.

High pressure steam should be used in connection with a blower.

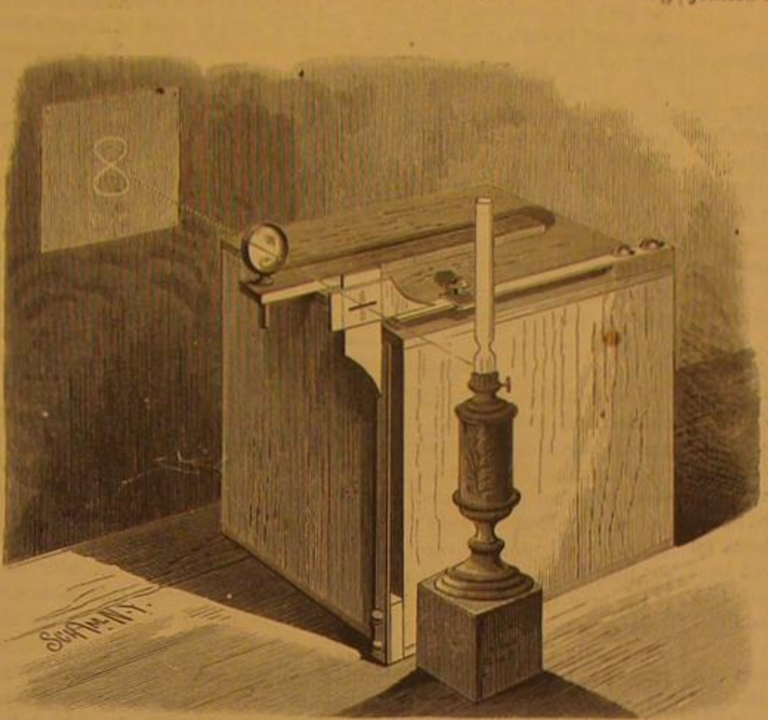
A temperature of 130° is considered good, and can be easily attained in a drying room.

The additional quantity of pipe necessary to raise the temperature of a drying room from 120° to 130°, if added again, will not raise it from 130° to 140°.

APPARATUS FOR COMBINING RECTANGULAR VIBRATIONS.

BY GEORGE M. HOPKINS.

There are several well known methods of combining rectangular vibrations to form the beautiful and instructive figures produced by M. Lissajous by means of two tuning forks carrying small mirrors and vibrating in planes at right angles to each other. The engraving shows still another method of accomplishing the same thing in a simple and inexpensive way; all the materials needed being a box about 24 inches square, two flat springs of wood, $1\frac{1}{4}$ inches wide, $\frac{1}{8}$ inch thick, and 24 inches long; or two springs of metal $\frac{1}{16}$ inch thick, 1 inch wide, and the same length. These springs are secured to the sides of the box at diagonally opposite corners, by stout screws, a block 1 inch thick and 4 inches long being placed between the end of the spring and the box, to give space for the vibration of the spring.



APPARATUS FOR COMBINING RECTANGULAR VIBRATIONS.

Upon the free end of each spring, and in the plane of its vibration, is cemented a piece of thin cardboard, having a longitudinal slit $\frac{1}{8}$ inch wide, parallel with the spring to which the card is attached. The slits in the two cards intersect each other at right angles, forming at their intersection a clear aperture $\frac{1}{8}$ inch square. The two cards are placed as near each other as possible without touching. One of the springs carries an adjustable weight, the use of which is to change the period of the vibration of the spring by placing it in different positions. The weight is shown in the engraving on the horizontal spring, but it may be shifted to the vertical spring when a slow vibration is required.

If the two springs are set in motion by snapping them simultaneously with the thumb and finger, the square aperture formed by the intersection of the slits in the two cards will move so rapidly as to appear like a band of light, *i. e.*, supposing the operator to be looking through the aperture toward the light. If the two springs vibrate in unison the band will either be perfectly straight, bisecting the angle formed by the two springs, or it will be elliptical or circular. By changing the period of the vibration of one of the springs so that the periods of the two springs will be to each other as 1:2, the band of light will assume the form of the figure 8. Make the vibrations as 2:3, and the figure representing the fifth will be formed, and so on throughout the whole range of compound vibrations.

To project these figures on a screen all that is required is to place a lamp at one side of the slitted cards, and a magnifying glass of about six inches focus on the other side, as indicated in the engraving. An easy way to hold the magnifying glass in position is to place the handle in a hole in a board, the latter resting on the top of the box. This rude device admits of moving the lens forward or backward, and to the right or left, as may be required.

Arranged in this manner the figures may be made to occupy an area of 12 to 16 inches square on the screen. The same method applied to a lantern slide produces figures of any required size. Of course the construction of the apparatus is materially different in this case, and the workmanship necessarily finer.

If continuous action is desired electro-magnets may be applied as in the electrical diapason described by me in this journal some months since.

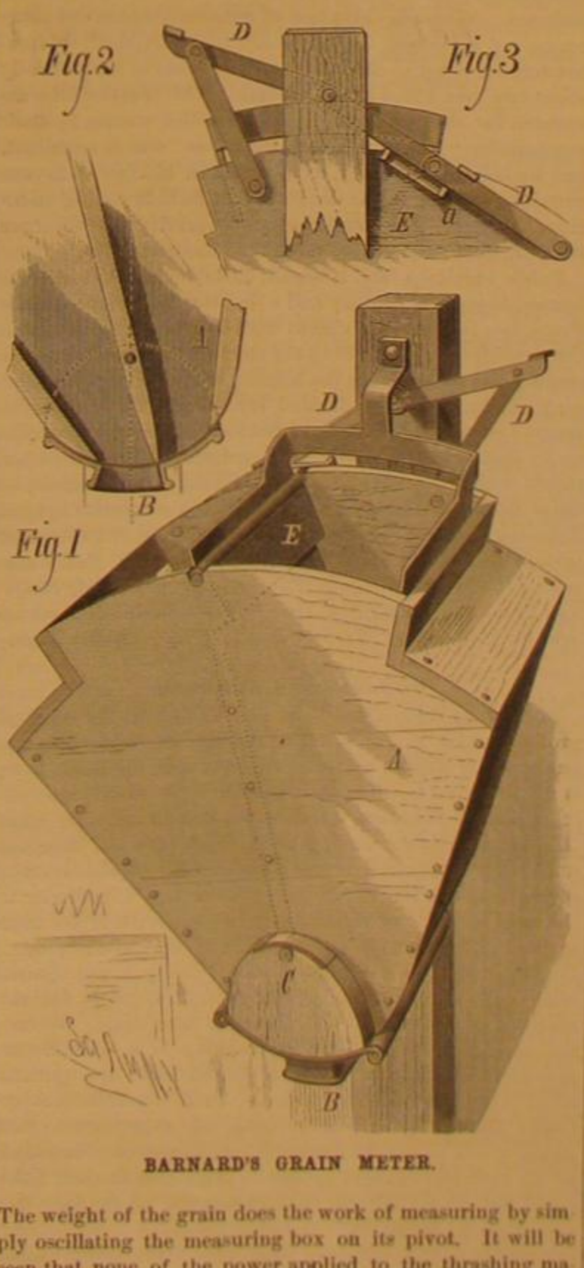
A Cæsarean Operation.

Twelve Philadelphia physicians lately assisted at the delivery of Mrs. William Burnell, by cæsarean operation. The mother is a dwarf, thirty-two years old, and forty-two inches high. Owing to a peculiar deformity it was seen that it would be impossible for her to give birth to the child in the usual manner. Porrow's method was adopted.

An incision was made on the median line of the abdomen, and the abdominal walls were cut through. The womb was removed, an incision made in it to correspond with those in the abdominal walls, and the infant released. After that the womb was restored to its bed and closed, and the other parts brought together. The clothing and all articles in the room were subjected to a solution of carbolic acid spray, according to Lyster's method, during the operation. The pulse of the woman remained excellent throughout the whole of this severe trial, and all her symptoms were favorable. At last reports both mother and child were doing well. Both would have died except for the heroic treatment adopted.

NEW GRAIN METER.

The grain meter shown in the engraving is designed to be used chiefly on thrashing machines, and can be readily attached to any separator, requiring no extra devices, except an elevator to carry the grain to it from the grain shute.



BARNARD'S GRAIN METER.

The weight of the grain does the work of measuring by simply oscillating the measuring box on its pivot. It will be seen that none of the power applied to the thrashing machine is consumed by the grain meter, which is entirely automatic and only requires to be supplied with empty sacks. The inventor informs us that actual use has proven that this meter is accurate and reliable and a great saver of labor.

In the engraving, Fig. 1 is a perspective view of the grain meter; Fig. 2 is a detail view of the locking mechanism; and Fig. 3 shows the valve at the bottom of the measuring box.

The box, A, is of quadrantal form, made convex at its lower end, and fitted to a concave valve, B, which is concentric with the pivot, C, upon which the box, A, oscillates. To the side of the box next its support are attached two jointed locking braces, D, which alternately lock the box in one or the other of its positions, and across the top of the box above the central partition which divides the box into two equal compartments, there is a wicket, E, whose pivot is extended beyond the side of the box and provided with two equal and opposite arms, *a a*, which are capable of touching the joints of the braces, D, and of unlocking them, so that the measuring box may swing and discharge one of the compartments, while the other is brought under the shute to be filled. The wicket, E, is operated by the pressure of grain when the compartment of the measuring box becomes filled. It will be noticed that the valve, B, having an opening of the same size as the opening of one of the compartments, only one side of the measuring box can be discharged at a time. Two strokers are attached to the standard supporting the measuring box, and brush the surplus grain from one compartment of the box, A, to the other. The speed with which the apparatus operates is controlled entirely by the quantity of grain flowing from the thrasher.

This useful invention was recently patented by Mr. George W. Barnard, of Economy, Wayne county, Ind.

The Color Blind Scare.

Connecticut is, we believe, the first State to pass a law prescribing certain regulations to be observed by railroad companies in regard to this subject. If all the other States should follow suit, and each of them enact a law as crude, vexatious, unjust, and annoying as this pioneer specimen, the skilled ophthalmic experts all over the land may safely count upon having a good time, however it may be with locomotive engineers and others who have rendered long and acceptable service upon our best managed roads. There is sure to be blundering, short-sighted work, when legislators who have no practical and scarcely any theoretical knowledge of railroad operation, undertake to remedy supposed defects in the system which in some unaccountable way have escaped the notice of the shrewdest and most capable managers; and the liability to blunder is none the less when the mercenary greed of a selected corps of professional experts is to be satiated at the rate of two dollars a head for the great army of railway employes whose duties require them to have anything to do with the form and code of signals. And so the companies must be taken in hand, and reliable and long-tried engineers, who have never had an accident on the road, driven from service because they can't read letters three-eighths of an inch long at a distance of 25 feet, or sort colored worsteds in a scientific manner, or see red and green precisely as some other people do, although they are able to discriminate just as sharply between the two, and be as little liable to confound or mistake one for the other. The logic of facts shows conclusively that the danger from color blindness, about which such a hue and cry has been raised, is greatly exaggerated, and that in no single one of the many careful and searching investigations that have been made in the past history of railroads, has the cause of an accident been traced to color blindness, nor has this particular cause even been suggested or suspected, so far as we have been able to ascertain from the record.—*National Car Builder.*

The Voice.

Dr. Ward, of New York, says on this subject, of the many agents which have more or less influence on the voice, the four principal are climate, dress, diet, and exercise. Change of climate may cause some slight deleterious effect on the larynx, but this influence is greatly overestimated. The present fashionable style of dress is decidedly unhealthy. The chest and abdomen are unnaturally confined, the lungs and other organs acting abnormally. All clothing should be loosely attached to the body, and the dress worn high. Avoid as much as possible appearing in full dress. The throat should not be wrapped in comforters, boas, etc. Chest protectors should not be worn, and the feet should be guarded against wet. The diet of the singer should be bland as well as nutritious. Of the different kinds of meat, venison, poultry, roast beef, and lamb are the easiest to digest, and due proportion of fat should be taken as a heat-supplying principle to the body. Cooked vegetables, unless too highly seasoned, are easily digested. Salads, cut cabbage, cucumbers, etc., should be avoided. Pastry should be invariably discarded. Dinner at noon, followed by a light tea at nightfall, is a rule which, if rigidly adhered to, will be a safeguard against all ordinary attacks of indigestion. In order that the act of singing be properly performed, it is absolutely necessary that the stomach be nearly empty. Alcoholic beverages should not on any consideration be indulged in by vocal artists.

For the full development and preservation of the vocal cords several rules must be observed. The exercises must be regularly and systematically practiced; they must always be within the register; they should never be pushed to the point of fatigue; they should never be made use of when the vocal organs are attacked with cold, no matter how slight. Always practice standing upright, so as to allow of full play of the lungs and accessory vocal organs. Bodily exercise is especially beneficial to the singer. In short, learning to sing is learning to be healthy.—*The Monthly Magazine.*

Ice at High Temperatures.

Prof. Thomas Carnelley writes as follows to the *Chemical News:*

Numerous experiments which I have made during the last few weeks on the boiling points of substances under low pressures, the details of which will shortly be published, have led to the following conclusions in reference to the conditions necessary for the existence of any substance in the liquid state. These are two in number, viz.:

1. In order to convey a gas into a liquid the *temperature* must be *below* a certain point (termed by Andrews the *critical temperature* of the substance), otherwise no amount of pressure is capable of liquefying the gas.

2. In order to convert a solid into a liquid the *pressure* must be *above* a certain point, which I propose to call the *critical pressure* of the substance, otherwise no amount of heat will melt the substance.

If the second of the above conditions be true, it follows that if the necessary temperature be attained, the liquefaction of the substance depends solely on the superincumbent pressure; so that if by any means we can keep the pressure on the substance below its critical pressure, no amount of heat will liquefy it, for in this case the solid substance passes directly into the state of gas, or, in other words, it sublimes without previous melting.

Having come to this conclusion, it was easily foreseen that if these ideas were correct it would be possible to have *solid ice at temperatures far above the ordinary melting point.* After several unsuccessful attempts I was so fortunate as to attain the most perfect success, and have obtained solid ice at temperatures so high that it was impossible to touch it without burning one's self. This result has been obtained many times and with the greatest ease, and not only so, but on once occasion a small quantity of water was frozen in a glass vessel which was so hot that it could not be touched by the hand without burning it. I have had ice for a considerable length of time at temperatures far above the ordinary boiling point, and even then it only sublimed away without any previous melting. These results were obtained by *maintaining* the superincumbent pressure below 4·6 mm. of mercury, *i. e.*, the tension of aqueous vapor at the freezing point of water. Other substances also exhibit these same phenomena, the most notable of which is mercuric chloride, for which latter the pressure need only be reduced to about 420 mm. On letting in the pressure the substance at once liquefies.

On the Absolute Invisibility of Atoms and Molecules.*

BY PROF. A. E. DOLBEAR.

Maxwell gives the diameter of an atom of hydrogen to be such that two millions of them in a row would measure a millimeter, but under ordinary physical conditions most atoms are combined with other atoms to form molecules, and such combinations are of all degrees of complexity; thus, a molecule of water contains three atoms, a molecule of alum about one hundred, while a molecule of albumen, according to Mulder, contains nine hundred atoms, and there is no reason to suppose albumen to be the most complex of all molecule compounds. When atoms are thus combined it is fair to assume that they are arranged in the three dimensions of space, and that the diameter of the molecule will be approximately as the cube root of the number of atoms it contains, so that a molecule of alum will be equal to

$$(\sqrt[3]{100} = 4{\cdot}64)\ \frac{4{\cdot}64}{2000000} = \frac{1}{431000}\ \text{mm.},$$

and a molecule containing a thousand atoms will have a diameter of $\frac{10}{2000000} = \frac{1}{200000}$ mm. Now, a good microscope will enable a skilled observer to identify an object so small as the $\frac{1}{4000}$ mm. Beale, in his works on the microscope, pictures some fungi as minute as that, and Nobert's test bands and the markings upon the *Amphiplura pellucida*, which are of about the same degree of fineness, are easily resolved by good lenses. If thus the efficiency of the microscope could be increased fifty times ($\frac{200000}{4000} = 50$) it would be sufficient to enable one to see a molecule of albumen, or if its power could be increased one hundred and seven times it would enable one to see a molecule of alum.

Now, Helmholtz has pointed out the probability that interference will limit the visibility of small objects; but suppose that there should be no difficulty from that source, there are two other conditions which will absolutely prevent us from ever seeing the molecule.

1st. Their motions. A free gaseous molecule of hydrogen at the temperature of 0° C., and a pressure of 760 mm. mercury, has a free path about $\frac{1}{10000}$ mm. in length, its velocity in this free path being 1,860 m. per second, or more than a mile, while its direction of movement is changed millions of times per second. Inasmuch as only a glimpse of an object moving no faster than one millimeter per second can be had, for the movements are magnified as well as the object itself, it will be at once seen that a free gaseous molecule can never be seen, not even glimpsed. But suppose such a molecule could be caught and held in the field so it should have no free path. It still has a vibratory motion which constitutes its temperature. The vibratory movement is measured by the number of undulations it sets up in the ether per second, and will average five thousand millions of millions, a motion which would make the space occupied by the molecule visibly transparent, that is, it could not be seen. This is true for liquids and solids. Mr. D. N. Hodges finds the path of a molecule of water at its surface to be 0·0000024 mm., and though it is still much less in a solid it must still be much too great for observation.

2d. They are transparent. The rays of the sun stream through the atmosphere, and the latter is not perceptibly heated by them as it would be if absorption took place in it. The air is heated by conduction and contact with the earth, which has absorbed and transformed the energy of the rays. When selective absorption takes place the number of rays absorbed is small when compared with the whole number presented, so that practically the separate molecules would be too transparent to be seen, though their magnitude and motions were not absolute hinderances.

* Read before the American Association.

Lightning Strokes.

The fatalities from lightning are very much greater in number and extent than is generally supposed. In European Russia alone the deaths for five years—1870–74—were 1,452 men and 818 women. No fewer than 4,092 fires are here also officially reported from the same cause during this period. In Prussia, were the registration of the causes of death is exceptionally careful, 1,004 persons were reported as killed by lightning in the nine years from 1869 to 1877. If we may trust the report of our Registrar-General this country is more fortunate in this regard, for during the same period only 194 such deaths are registered for England and Wales; but our returns are admittedly incomplete.

In Austria—from 1870 to 1877 (eight years)—lightning occasioned upward of 40,000 fires, and destroyed more than 1,700 lives. In Switzerland the returns seem curiously variable. For example, in 1866 only three such deaths are reported; while in 1877 we find as many as thirty. Of the deaths by lightning in France, M. Boudin some years ago collected statistics, which showed that during the thirty years, beginning in 1834 and ending in 1863, as many as 2,038 people were struck dead by lightning in that country. During the last ten years of this period the deaths amounted to 880, and of these only 243 were women. Nothing, indeed, is more striking in these statistics than the uniform preponderance in the numbers of the male over those of the female sex. With the exception of Sweden—where, for some reason not explained, and not easily to be imagined, this preponderance is not so observable—there seem to be generally about two men killed to one woman. The traveler who accounted for the immunity of the Swedish women by their comparative "lack of personal attractions" was as ungallant, and we believe, moreover, as incorrect in his fact as he was certainly wanting in the decorum that forbids jesting on serious subjects. The country seems invariably to suffer more than the town; the village more than the great city.

Public buildings fare, it seems, little better than private houses, though a century and a quarter has elapsed since Franklin's famous experiment with the kite demonstrated the possibility of controlling the electric fluid, and nearly a century has passed since the learned, taking interest in lightning conductors, were divided into hostile factions on the famous question of "knobs or points." Mr. Anderson estimates that at least one-half, and perhaps two-thirds of the public buildings, including the churches and chapels, of Great Britain and Ireland, are without any protection against lightning; while it is believed that not five out of a thousand private houses are fitted with conductors. St. Paul's was among the first buildings in Europe to be protected, Benjamin Franklin's "lightning rods" having been first set up over Sir Christopher Wren's dome in 1768.—*London News.*

On Sound as a Nuisance.

For a long time it has been well known to the medical profession that in various critical states of the human system absolute silence, or the nearest possible approach to it, is not the least important condition to be secured. Accordingly muffled knockers, streets covered with straw or spent tan, and attendants moving about with noiseless step, are universally recognized as the signs and the requirements of severe disease. But the truth that noise is a contributor to the wear and tear of modern city life has scarcely yet been realized by the faculty, not to speak of the outside public. Consequently, while a zealous war is being urged against other anti-sanitary agencies, no general attempts for the abolition of superfluous noise have yet been made. We cannot, perhaps, give anything approaching to a scientific explanation why sound in excess should have an injurious effect upon our nervous system. Prof. Berthelot has recently shown, by a careful series of experiments, that sound waves do not, like thermic and luminous vibrations, set up chemical changes in bodies submitted to their influence; but our inability to give an account of the fact does not affect its existence. We feel that noise is distressing, exhaustive. The strongest man after days spent amidst noise and clatter, longs for relief, though he may not know from what. It may even be suggested that the comparative silence of the sea-side, the country, or the mountains, is the main charm of our summer and autumn holidays, and contributes much more than does ozone to restore a healthy tone to the brains of our wearied men of business. Indeed, if we consider, we shall find that this is the most unnatural feature of modern life. In our cities and commercial towns the ear is never at rest, and is continually conveying to the brain impressions rarely pleasant, still more rarely useful or instructive, but always perturbing, always savoring of unrest. In addition to the indistinct but never-ceasing sea of sound made up of the rolling of vehicles, the hum of voices, and the clatter of feet, there are the more positively annoying and distracting elements, such as German bands, organ grinders, church bells, railway whistles, and the like. In simpler and more primitive times, and to some extent even yet in the country, the normal condition of things is silence, and the auditory nerves are only occasionally excited. It is scarcely to be expected that such a change can be undergone without unpleasant consequences.

The question has been raised, why should some noises interfere with brain work by day and disturb our rest at night so much more than others? A strange explanation has been proposed. We are told that sounds made incidentally and unintentionally—such as the rolling of wheels, the clatter of machinery (except very close at hand), the sound of footsteps, and, in short, all noises not made for the sake of noise—distress us little. We may become as completely habituated to them as to the sound of the wind, the rustling of trees, or the murmur of a river. On the other hand, all sounds into which human or animal will enters as a necessary element are in the highest degree distressing. Thus it is, to any ordinary man, impossible to become habituated to the screaming of a child, the barking and yelping of dogs, the strains of a piano, a harmonium, or a fiddle on the other side of a thin party-wall, or the clangor of bells. These noises, the more frequently we hear them, seem to grow more irritating and thought-dispelling.

But while admitting a very wide distinction between these two classes of sounds, we must pause before ascribing these differences to the intervention or non-intervention of will. We shall find certain very obvious distinctions between the two kinds of sound. The promiscuous din of movement, voice, and traffic, even in the busiest city, has in it nothing sharp or accentuated; it forms a continuous whole, in which each individual variation is averaged and toned down. The distressing sounds, on the other hand, are often shrill, abrupt, distinctly accentuated and discrete rather than continuous. Take, for instance, the ringing of bells: it is monotonous in the extreme, but it recurs at regular intervals. Hence its action upon the brain is intensified, just as in the march of troops over a suspension bridge each step increases the vibration. The pain to the listener is the greater because he knows that the shock will come, and awaits it. Very similar is the case with another gratuitous noise, the barking of dogs. Each bark, be it acute or grave, is in the highest degree abrupt, sharply marked, or *staccato*, as we believe a musician would term it. Though the intervals are less regularly marked than in the case of church bells, we still have a prolonged series of distinct shocks communicated to the brain. Well might Goethe say,

"Vor allem
Ist das Hundegebell mir verhasst;
Klaffend zerreisst es das Ohr."

All the other more distressing kinds of noise possess the characters of shrillness, loudness, and of recurrent beats or blasts.

As an instance of an undesigned, unintentional noise being distressing to those within ear-shot, we may mention the dripping of water. A single drop, whether penetrating through a defective roof, falling from the arch of a cavern, or issuing from a leaky pipe, and repeated at regular intervals, is as annoying as the tolling of a bell, the barking of a dog, or the short, sharp screams of a fretful infant. The only difference is that the noise is not heard as far. We may hence dismiss the "will" theory, and refer the effects of noises of this class to regularity, accentuation, and sharpness.

It is particularly unfortunate that the multiplication of sound should accompany, almost hand in hand, that increase of nervous irritability and that tendency to cerebral disease which rank among the saddest features of modern life. A people worn out with overwork, worry, and competitive examinations might at least be spared all unnecessary noise. Many persons cannot or will not understand how necessary silence is to the thinker. A friend of the writer's, engaged in investigating certain very abstruse questions in physics, is often compelled to throw aside his work when an organ grinder enters the street, and suffers with acute pain in the head if he attempts to go on with his researches.

We should therefore propose, as measures of sanitary reform, the absolute prohibition of street music, which is more rampant in London than in any other capital in Europe. The present law, which throws upon the sufferer the burden of moving in the matter, is a mere mockery. Another necessary point is the abolition of church bells. In these days of innumerable clocks and watches every one can tell when it is the time for divine service without an entire neighborhood being disturbed for some twenty minutes at a time. Nonconformist places of worship collect their congregations without this nuisance. Further, all dogs convicted of persistent barking should be disestablished. And lastly, harmoniums, American organs, and wind instruments in general should be prohibited, except in detached houses.—*Journal of Science.*

THE WOOL SORTER'S DISEASE.

The danger which lurks in the dust and dirt of old rags, and especially hair and wool, is, during their manipulation preparatory to being transformed into paper, felt, or cloth, a very serious matter for the workmen employed. The exceedingly unclean condition in which the bales of rags and hair are received in the factories necessitates their being first cleaned and sorted by hand, and this operation is often fraught with the gravest consequences, scattering sometimes the seeds of loathsome and fatal diseases. The sorting room is provided with tables, at each of which is a worker, usually a woman; at her side is an open bale, from which she chooses a handful at a time and deposits on the table: this liberates a great deal of dust. In many cases the dust contains the germs of the horrible disease called "anthrax," "malignant pustule," "charbon," and "Siberian plague." These germs possess singular vitality and virulence, developing in the human subject the loathsome and fatal malady called "wool sorter's disease." It is not, however, confined to wool, as the germs of the fungoid organism, "*Bacillus anthracis*," are found in every description of hair and wool, and most frequently in the Siberian horse manes, which are largely imported in England for the manufacture of hair cloth. Neither is the disease confined to the sorters; the infected dust is mingled with the air and gets outside the works, or it is distributed among manure dealers who buy the refuse dirt. This has recently been conclusively proved by cases in Glasgow, Bradford, and elsewhere.

Manufacturers in England are therefore contemplating the disinfection of all dangerous hair and wools. It is proposed to empty the bales in a fanning arrangement, burn the coverings, or, soaking them in refuse sulphuric acid, changing them into manure by the addition of gypsum as a drier. The fine dust blown out by the fan is to be discharged under the fire bars of a steam boiler, where it will be promptly and effectively destroyed. The heavier dust falling on the bottom, and now sold for manure making, is to fall at once into a lead tank with sulphuric acid and treated like the coverings; this dust from hair and wool is rich in phosphates and ammonia, and is, therefore, a valuable fertilizer, while the acid increases its fertilizing properties and utterly destroys any germs present. Carbolic acid is to be used for disinfecting the hair, as chloride of lime or bleaching powder injures the fiber.

In order to show the urgency of these precautions we recite some of the details of one of the cases lately reported in an English medical journal: William Otley, aged 63, employed by Mitchel Brothers, Bradford, to prepare mohair after it had passed through a washing and scouring process necessary to manufacture it into yarn. He had first a small pimple upon his chin; this increasing and making him feel unwell, he staid home. A physician was sent for, and found swelling of the under jaw setting in. As the pustule increased rapidly, and constitutional symptoms showed themselves, the malignity of the case was soon recognized and all hope of staying the disease was lost. Three days later the patient died. On the morning of that day the doctor took a little blood and serum from the affected part, and, submitting it to a microscopic examination, discovered the organism known as "*Vacellus anthracis*," now universally recognized among pathologists as the cause of splenetic fever in cattle, and that form in which it is identical with wool sorter's disease.

No doubt the pimple on the chin had been innoculated by the virus, the development of which caused the man's death. After his decease the upper part of his body underwent a most rapid decomposition.

A NEW FIRE APPARATUS.

The portable standpipe fire extinguishing apparatus, invented by Abner Greenleaf, of Baltimore, appears to be the most meritorious original addition to the armory of firemen that has been made for many years. It has been on trial in this city during the past year, and on several occasions has proved of the highest practical utility. It is made in three sections, the lower being mounted permanently on trunnions, while the other two are carried on a side rack. On reaching the fire the two upper sections are coupled with the first, making a pipe fifty feet long. The pipe is raised in a minute by means of a hand wheel at the rear of the truck, and quickly connected at the base with the water supply. A shorter substitute for the upper section of the pipe is carried for use when the fire is so low that the nozzle height of thirty-five feet is sufficient. Different sized nozzles can be used with both lengths of pipe. The apparatus is supported by the truck wheels, and weighs 6,500 pounds. The great advantage of the tower lies in its getting a solid stream of water forty or fifty feet nearer the fire by raising the point of delivery. By means of a flexible pipe at the top of the tower, operated from the ground, the stream can be projected in any direction, sweeping an entire block if necessary. This contrivance presents a marked advantage over self-supporting ladders for several reasons. It is not necessary to provide for the weight and safety of men aloft. The man on the truck, in comparative safety, has full freedom of action, and can be cool enough to direct the stream to the points most needing attention. Less power is required at the engine to raise the water to the desired height, the friction of the pipe being less and the course more free from bends. The pipe can be put in working condition in three minutes after its arrival in front of a building on fire; and in several instances in this city it has been the means of saving valuable property in which the fire would otherwise have been beyond control. It is intended eventually to have one portable pipe to each battalion of the fire service, so located that two or three can be brought to bear at any fire.

FALL OF A METEORIC STONE.

It has been doubted by some if ever a meteoric stone has been found which had also been seen to fall. It is well known that the meteorites in our mineralogical cabinets have been picked up in various parts of the world, and it is by their chemical composition that they are judged to be of cosmical origin. At the other side the observation of falling meteors is quite common, but seldom, if ever, has the falling body been found, hence the doubt in regard to them which exists still in many minds. Any record, therefore, of the observed falling of such a stone and its finding, while still hot, on the spot where it fell, is of interest. Such a record was recently furnished by Mr. W. Emerson Mead, of New York, the tenant of whose cottage near Schroon Lake makes the following report, dated September 23:

"Last night, while it was dark outside, the clouds being black and heavy, it became at once light as noonday. I jumped to the window, and saw the barn plain as during the day time, at the same time the house was shaken from cellar to garret. I went out of the house to investigate, and found, twenty feet from the house, a red-hot stone weighing about 125 pounds, and having indented 'the soil about six inches, and in a direction as if it had come from the northeast. I threw kerosene on it, and this burned up at once, so did sulphur. The next day it was seen by a number of people, and $25 offered for it. It was not sold, however."

By order of the owner a little house is being built over the spot, and the stone left in position for the benefit of scientists to study its position and peculiarities.

Petroleum Abroad.

The *American Mail* predicts a vast increase in the consumption of petroleum during the next five years. It has been forcing its way among the "exclusive races," such as the Chinese, the Persians, the Moors, etc. The natural persistence of those eminently conservative peoples, who worship old things and old usages, was considerably strengthened by their fear of kerosene. Both the British and American consuls in China and Persia now report that the people are surmounting their fears and their prejudices and taking to the use of petroleum. A late report from our consul at Tripoli, of Barbary, states that petroleum is daily becoming more popular in that country, and the fears at first entertained in regard to its explosiveness are gradually disappearing. It is now used by all the city Arabs, and gradually reaching out to the country people. The same is true of India. Wherever our petroleum goes, our exporters should see that our lamps go with it. They should also remember that, in addition to its utility and superiority as an illuminator, its cheapness is its principal recommendation to those Eastern millions. Cheap petroleum and simple, safe, and inexpensive lamps should be our motto.

The New Comet.

On every evening since its announcement, interesting observations have been made at my observatory of the splendid telescopic comet now visible in the western evening sky.

The comet was discovered in this country at the Ann Arbor Observatory on the 13th of September, 1880, in R. A. 14 hours 38 minutes, north declination 29 degrees 20 minutes, and so announced in the papers last Saturday morning. On Saturday afternoon, however, a telegram was received by me from Europe via Washington, announcing its discovery by Hartwig at Strasburg, on the 29th ult., one day previous to its discovery in this country, in R. A. 14 hours 8 minutes, north declination 29 degrees 45 minutes. It is a superb telescopic object, and when seen by me on the evening of its announcement it was situated about 3½ degrees below Alphecca, or Alpha Corona Borealis. The next evening (October 3) it was in the same field of the telescope with that star, and presented a very fine appearance. Last evening—October 4—it was very close to the star Delta Corona Borealis. It is just visible to the naked eye, but it is not growing any brighter as was at first hoped, although it will doubtless be visible for some time. It has a large bright head with a sparkling nucleus, and a faint tail about two degrees in length. The head is nearly as bright, in the telescope, as the great cluster in Hercules. The tail points upwards or away from the sun. It is moving about 3 degrees daily in an easterly direction, or nearly in a line drawn from Alphecca to Altair in the Eagle. It is a beautiful object, and its scientific value will be very great. By following the direction of its motion just given no one will have any trouble in finding the comet with quite a small telescope, and it will be well worth the search.

WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y., October 5, 1880.

The Wrong Journal Credited.

An article designating the qualifications incident to "a model workman," which appeared in this paper a few weeks ago, should have been credited to the *American Machinist*, instead of the publication to which the credit was accorded. If publishers would be more punctilious in crediting the source from which their articles are derived, much annoyance would be saved to the editor and publisher entitled to the credit.

DECISIONS RELATING TO PATENTS.

United States Circuit Court.—Northern District of New York.

ROGERS *vs.* BEECHER *et al.*—BIRCH BEER PATENT.

Wallace, J.:

1. A patentee is entitled to the presumption of priority which his patent affords, and this presumption is only overcome by clear and satisfactory proof to the contrary.

2. The plaintiff is obliged, in order to recover damages, to prove affirmatively that the defendants have employed the invention patented, and having in this case failed to do so satisfactorily, the bill was dismissed.

United States Circuit Court—Eastern District of Pennsylvania.

HOFFMAN *vs.* YOUNG.—PATENT SURVEYOR'S TRIPOD.

Butler, J.:

1. A mere aggregation of old parts without any new result issuing from the united action is not patentable.

2. Old parts to be patentable must combine in operation and by their joint effect produce a new result. They need not act simultaneously, but if so arranged that the successive action of each contributes to produce the result, which, when obtained, is the product of all the parts, viewed as a whole, a valid claim for this combination may be sustained.

3. No rule of universal application has been laid down defining a patentable combination, but two things are always necessary; first, a novel assemblage of parts exhibiting invention; second, the co-operation of parts in producing a new result.

4. By the term "co-operation" the courts do not mean merely acting together or simultaneously, but united to a common end—a unitary result.

By the Commissioner of Patents.

HUNTLEY *et al. vs.* SMITH.—PATENT MIDDLINGS PURIFIER.—INTERFERENCE.

Marble, Commissioner:

1. When the party last in Office does not in his preliminary statement allege a conception of the invention in controversy earlier than the record date of the party first to file his application, it does not overcome the *prima facie* case made by the date of application, and judgment on the record should be rendered against him.

2. The mere fact that an earlier application was made by the party disclosing the invention in dispute cannot avail to give a *prima facie* date of invention in this proceeding, unless there is some reference in the later application which serves to connect it with the former.

3. While the filing of an application does not prove reduction to practice, it establishes the fact of invention.

4. Applications diligently prosecuted evince a faith on the part of the inventor in the practicability of the invention equal to that which would follow from a reduction of the same to practical form, and the latter is not a condition called for in the statute.

5. In cases of long delay to prosecute the invention beyond mere description, either by applying for a patent or by a reduction to practical form adapted to use, the question of abandoned experiment or conception will arise and should be considered a factor in the case.

The Electric Telegraph as an Aid to Fishermen.

From time immemorial the fishermen of the Mediterranean shores, of Cornwall, and of the Scandinavian coasts, have been directed in their work by lookouts stationed upon cliffs to discover the approach of the finny schools. Of late the enterprising fishermen of Norway have called to their aid the electric telegraph, laying down more than twelve hundred miles of wire, to bring the fishers into instant communication with the watchers, and to notify the fish merchants where to go for supplies. The Norwegian coast gives employment to 40,000 fishermen during a large part of the year.

Elevated Railway Traffic.

The number of passengers carried on all the lines of elevated railway in New York, the year ending September 18, 1880, was 60,386,073, divided as follows:

Third avenue	31,168,686
Ninth avenue	5,237,541
Total New York Elevated	36,406,227
Sixth avenue	21,143,658
Second avenue	2,836,188
Total Metropolitan Elevated	23,979,846

Steamboats in Venice.

A company has been organized to introduce steamboats in the place of the gondolas which have so long held dominion in the street canals of Venice. This, a London journal remarks, may fairly be considered the climax of modern utilitarianism, a fitting supplement to the railway up Vesuvius, and the steam launches of the Nile. Travelers will of course lament the change and denounce the vandalism of the age; but they will take the steamboats and leave the few leaky gondolas that may ply to the undisturbed patronage æsthetes.

THE NIAGARA RIVER BRIDGE.—The credit for the admirable engineering skill displayed in the reconstruction of the railway bridge across the Niagara River, is due to Mr. L. L. Buck.

RECENT DEVELOPMENTS IN ELECTRIC LIGHTING.

[*Continued from first page.*]

nets of the large machine, and consequently controlling the current in the external circuit.

On the top of the magnets of the exciting machine there is a platform supporting a train of gearing, consisting of two ratchet wheels mounted on shafts carrying spur wheels which mesh into an intermediate wheel connected with the pivotal support of the commutator brushes by bevel gearing and a vertical shaft. The ratchet wheels are a short distance apart, and between them there is a double faced pawl, which is capable of engaging one or both of the ratchet wheels, or of moving between them without touching either. This pawl is reciprocated by an oscillating shaft at the rear of the magnet, which takes its motion from a small crank on a shaft above the armature and between the helixes of the magnets. The crank shaft receives a comparatively slow rotary motion from the shaft of the armature.

Above the ratchet gearing there is a table supported by pillars from the platform, and upon this table near one side there is an electro-magnet of high resistance, which is connected with the circuit wires, and is influenced by the current in the same manner as the incandescent lamps, which are connected in multiple arc. An armature is suspended above the electro-magnet by a nicely pivoted scale beam, and the downward movement of the armature is opposed by an adjustable spiral spring at the opposite end of the scale beam. The excursions of the scale beam are limited by stop screws in a vertical post near the electro-magnet. The end of the scale beam is prolonged beyond the armature to receive a rod, by which it is connected with the elongated end of the oscillating pawl playing between the ratchet wheels. The rod which connects the scale beam and the pawl is rendered elastic by the insertion of a short piece of spiral spring, to admit of the free action of the pawl in catching the teeth of the ratchet wheels. When the strength of the current is augmented by the removal of several lamps from the circuit, the armature of the regulator magnet is drawn down, permitting the pawl to engage with the lower ratchet wheel, which is turned one notch at a time until the commutator brushes are moved, so as to reduce the exciting current, and consequently diminish the current in the lamp circuit. Should the current diminish beyond the normal strength the armature is released, the spring moves the scale beam, bringing the pawl into engagement with the upper ratchet wheel, when the result will be opposite to that just described.

The incandescent lamps, in connection with which this regulator is more especially intended to be used, are connected in multiple arc; that is, they are connected across two parallel wires, so that the current is divided up between all of the lamps in the same circuit. Now, it is obvious that, when a number of the lamps are removed the current would, under ordinary circumstances, be much stronger in the lamps that are allowed to remain in the circuit, but when the regulator is applied there is no perceptible difference in the light given out by the lamps, whatever may be the number in circuit.

As many as sixty-four lamps have been brought up to over thirty candle power each in a single circuit by the machine shown in Fig. 3, and the lamps have been removed from the circuit until only one remained and then all replaced, the regulator meanwhile adapting the current perfectly to the widely varying conditions.

The incandescent lamp shown in Fig. 4 consists essentially of a glass globe containing an attenuated atmosphere of hydrocarbon vapor, in which is placed the carbon conductor, which is rendered incandescent by the electric current. The conducting wires, instead of being fused into the glass of the globe, are surrounded with a semi-elastic cement, which is capable of withstanding both heat and pressure. This cement insures a perfect and durable joint between the platinum electrodes and the glass. It is estimated by Mr. Maxim that the large dynamo-machine will supply a current to 200 of these incandescent lamps. The machine certainly has great power, and generates what might be called

THE ARC ELECTRIC LIGHT.—CARBONS, NATURAL SIZE.

a giant current, which is capable of heating eighty feet of No. 9 iron wire to incandescence, and of maintaining a 10 inch arc between two $1\frac{1}{4}$ inch carbons, shown in Fig. 5. The light from these carbons when one inch apart is simply immense, and the heat is like that of a blast furnace.

Mr. Maxim's interests are identical with those of the United States Electric Light Company, of this city, whose offices are located at 120 Broadway. This company is doing a great deal toward the introduction of the electric light in all forms, and have recently established a central station in the vicinity of Madison square, from which several radiating wires extend to public buildings in that locality. We hope at an early day to be able to chronicle the introduction of the small electric lamp into offices, stores, hotels, and private dwellings.

MISCELLANEOUS INVENTIONS.

Mr. George E. Eastman, of Muskegon, Mich., has patented a vehicle seat, whose ends and back are joined together with angle irons that enter corresponding vertical corner slots; the seat frame is mitered and secured in place by metallic plates, that are blind slotted into the corners.

Mr. Charles R. Kinehan, of Springfield, Ill., has patented a simple device for more readily and accurately circling and leveling the hair springs of watches. It consists of a sliding and rotating rod holding the spring, and fixed adjustably in a vertically adjustable stud or pillar that is connected with the top plate of the watch.

Mr. Enos G. Boughton, of Pittsford, N. Y., has patented an improved drying apparatus for drying substances such as fruits, vegetables, hops, meats, etc. The moisture is evaporated from such materials with dry air at ordinary temperature without the application or use of artificial heat, so that the natural flavor of the fruit is preserved.

An improved attachment for the key boards of musical instruments has been patented by Mr. Christopher C. Reynolds, of Kelseyville, Cal. The invention consists in a series of levers pivoted adjacent to each other in such a manner that they can be acted upon by a moving sheet which has the notes cut out or raised, and passes between two feed rollers, which draw it under the lower ends of the above-mentioned levers, having a cord or wire attached to the upper ends, the said cords or wires passing over or through suitable bridges, and being attached to the upper ends of a series of fingers resting on the keys of the instrument. By means of a crank the feed rollers are rotated, thus moving the music sheet as is necessary, and at the same time a roller arranged adjacent to and parallel with the row of fingers is rotated in such a manner as to assist in depressing the fingers, thereby relieving the music sheet from undue strain.

Mr. Philip B. Bicknell, of Lincoln, England, has patented an improved dark lantern for the use of policemen, watchmen, and others. It is an improvement on that general form of lantern which is constructed with a rounded front side and a flat or slightly concave rear side adapted to lie against the wearer, and in which the front portion is hinged to a back plate attached to the waist belt, so that the front portion may fold outwardly with the lamp to give access to the latter.

A closet or safe, which may be concealed in a wall and provided with secret devices for giving entrance thereto, has been patented by Mr. Nicholas Huetter, of Kenosha, Wis. The invention consists in a box fitted with a hinged cover that is held closed by sliding catches, and thrown open by a spring when released, and having combined with it a rockshaft and crank lever for operating the catches.

Mr. Humphrey J. Williams, of New York Mills, N. Y., has patented a carpenter's bench hook that can be easily set in position, adjusted, and removed. The invention consists, essentially, of a tubular shell carrying a toothed plate on its top, set at right angles thereto, the shell being longitudinally divided into two sections that inclose an eccentrically or cam threaded rod or screw, by means of which the sections are spread apart.

An improved vehicle spring brace has been patented by Mr. Charles A. E. Simpson, of Portsmouth, Ohio. The invention relates to means for preventing lateral

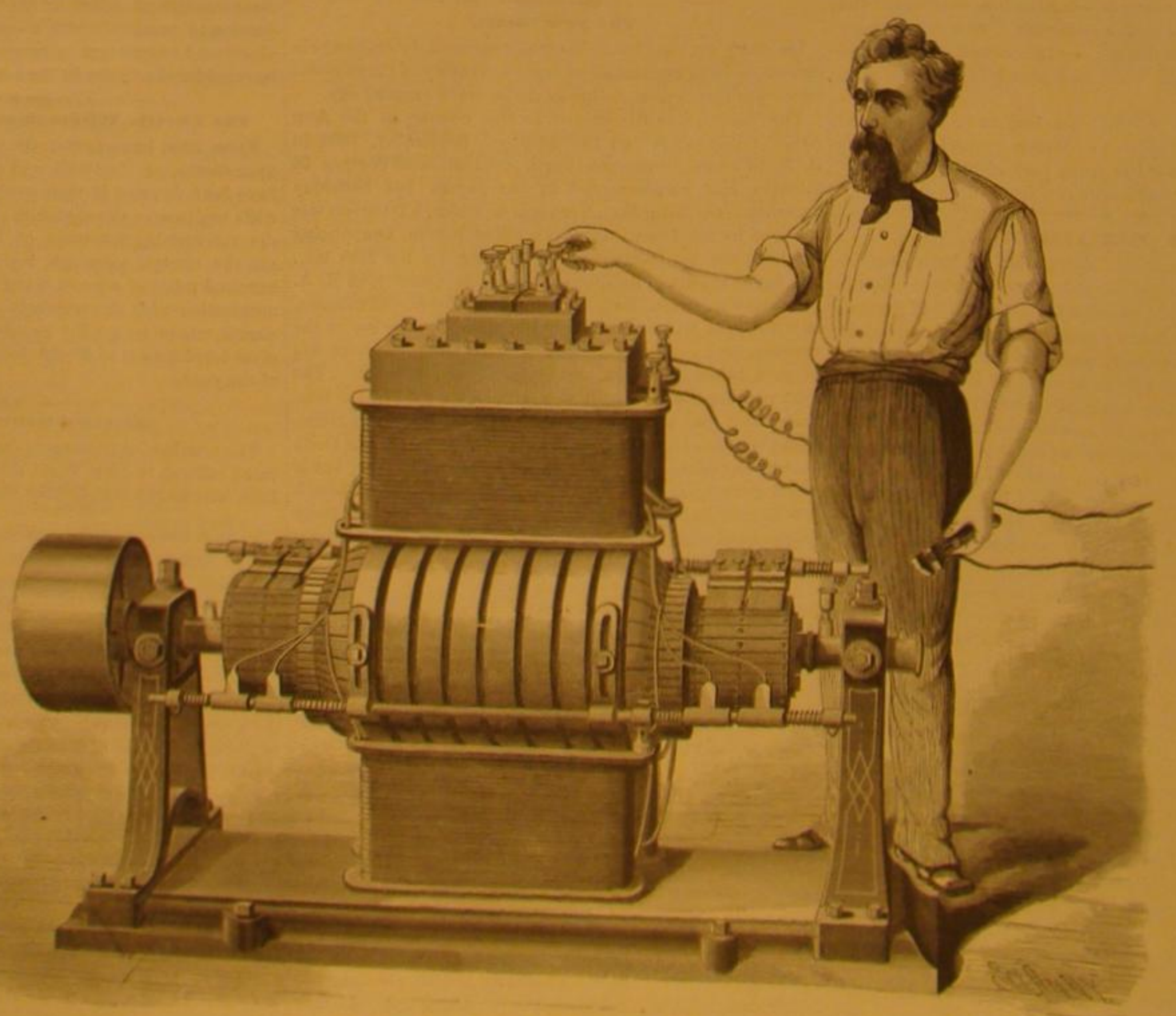


Fig. 3.—MAXIM'S DYNAMO-ELECTRIC MACHINE.

vibrations of the springs when they are depressed by the load or body of the vehicle in passing over rough surfaces or in ascending or descending a hill.

Mr. Aaron D. Cheney, of Three Oaks, Mich., has patented an improved apparatus for hatcheling or straightening and removing the gummy matter and roots from hair combings or other snarled and tangled hair. The invention consists in a bed or table fitted with hatcheling and combing teeth arranged in a peculiar manner. These teeth are carried by blocks fitted to slide in the bed to allow change or removal of the teeth and the substitution of fine and coarse teeth one for the other, as required.

LONG-BILLED PARROT AND BANKSIAN COCKATOO.

A very singular form of cockatoo is that which is known as the Philip's Island, or the long-billed parrot. This bird is only found in the little island from which it derives its name. It may probably become extinct at no distant period, as its singularly shaped beak renders it an object of attraction to those who get their living by supplying the dealers with skins and various objects of natural history; and its disposition is so gentle and docile, that it readily accommodates itself to captivity. Philip's Island is only five miles in extent; and it is a very remarkable fact that this long-billed parrot is never found even in Norfolk Island, though hardly four miles distant.

LONG-BILLED PARROT AND BANKSIAN COCKATOO.

Its favorite resorts are among rocky ground interspersed with tall trees, and its food consists mostly of long and succulent vegetable substances. The blossoms of the white hibiscus afford it a plentiful supply of food, and in order to enable it to obtain the sweet juices of the flowers the tongue is furnished with a long, narrow, horny scoop at the under side of the extremity, not very unlike the human nail. As earth has often been found upon the long upper mandible, the bird is believed to seek some portion of its food in the ground, and to dig up with its pickaxe of a bill the ground nuts and other subterraneous vegetation. This opinion is strengthened by the fact that another species of parrot belonging to the same country is known to seek its food by digging.

One species of this genus has been known to imitate the human voice with much accuracy. This is the southern Nestor, or the kaka of the natives (*Nestor hypopolius.*)

The birds which belong to the genus Nestor may at once be known by their extraordinarily long upper mandibles, which curve far over the lower, and remind the observer of the overgrown tooth so common in the rat, rabbit, and other rodent animals. Some persons suppose the long-billed parrots to form a link between the parrots and the cockatoos.

The Philip's Island parrot is dark brown on the upper surface of the body, but takes a grayish hue on the head and back of the neck. Each feather of the upper surface is edged with a deeper tinge, so that the otherwise uniform gray and brown is agreeably mottled. The cheeks, throat, and breast are yellow, warming into orange on the face. The inner surface of the shoulders is olive-yellow, and the abdomen and both tail coverts are deep orange-red. The tail is moderately long, and squared at the extremity.

The banksian cockatoo is a good representative of a very curious genus of cockatoos resident in Australia. The plumage of these birds, instead of being white or roseate, as in some other cockatoos, is always of a dark color, and frequently dyed with the richest hues. About six species belong to this genus, and they all seem to be wild and fierce birds, capable of using their tremendously powerful beaks with great effect. Their crests are not formed like those of the common cockatoo, and the tails are larger and more rounded.

The Banksian cockatoo is only found in New South Wales, inhabiting the vast brush district of that land. Its food is mostly of a vegetable nature, consisting chiefly of the seeds of the banksia; but the bird will also eat the large and fat grubs of different insects, mostly of a coleopterous nature, which it digs out of the trunks of trees with its strong bill.

The flight of this handsome bird is rather heavy, the wings flapping laboriously, and the progress being rather slow. It seldom mounts to any great height, and as a general fact only flies from the top of one tree to another. The eggs are generally two and sometimes three in number, and are laid in the hollow "spout" of a green tree, without any particular nest.

The chin of the adult male is deep rich black with a green gloss. A broad vermilion band crosses the whole of the tail, with the exception of the two central feathers, and the external webs of the outside feathers. The female is also greenish black, but her plumage is variegated with numerous spots and bars of pale yellow.

Eastport Sardines.

Eastport, Maine, depends for its prosperity almost entirely upon its fishing interests, large quantities of cod and other fish being caught within a few miles of the town. The putting up of small herrings sardine fashion has latterly become a prominent industry, giving employment to many fishermen and canners. The fish are very abundant at certain seasons, sometimes a hundred hogsheads being taken at one time. Large weirs are constructed along the shores and around the islands of Passamaquoddy Bay, and the fish, swimming in with the tide, are caught behind them. When the tide falls and the fish are crowded into narrow spaces, they are dipped out in great quantities. When taken to the extensive factories along the shores the fish are cured by boiling in oil, like sardines, and put up in small boxes in imitation of genuine sardines. The business is said to be controlled by New York firms. The fish are also potted and put up in various other ways. The large herrings taken during the winter are frozen and shipped to market in barrels.

England's 100-ton Gun.

A successful trial of England's new 100-ton gun was made September 22. Loaded with 441 pounds of pebble powder (in cubes of 1¼ inch) it drove a 2,000 pound projectile 45 feet into a sand butt. The velocity of the projectile was 1,556 feet a second.

The Daddy Long-legs in England.

For some four years past Miss E. A. Ormerod—a lady living at Dunster-lodge, Isleworth, who takes a great interest in meteorological and agricultural matters—has been collecting observations on injurious insects and plant life from all parts of the United Kingdom, and the success of her work may be imagined from the fact that this year some 400 observers—some as far north as Caithness—have sent in reports. These reports will not be published in the usual annual form until the observations of the entire year are completed. Enough is, however, now known of the great damage done this year, and of the experience gained in the destruction of these pests, to enable farmers and gardeners to protect themselves to a very great extent from their ravages in the future.

The reports from all parts of the country show that great damage has been done by the grubs of the *Tipula oleracea*—known better by the popular name of "daddy long-legs." Previous observations have shown wet weather to be favorable to the development of this fly, and the experience of the present year is quite in harmony with them. The eggs deposited in the clover stubbles last autumn produced myriads of grubs—as many as 150 to 200 sometimes in a square yard—which have been destructive to crops generally, but especially to corn. The grub works by gnawing the plant through, or partly through, beneath the surface of the ground, thus wasting far more than it needs for food, and as it can bear being thoroughly immersed for more than three days and nights, and can (at least, exceptionally) support a temperature of —10°—that is, 10° below zero, or 42° of frost—winter influences are not to be looked to for any very efficient help against it. The experiences of the present year also show that when the grub is fairly established in a field, special applications or dressings on the grub itself do but little towards killing it, and that the best remedies in a "grub run" field are dressings of guano, or of any quick acting manure that will stimulate and encourage a healthy and vigorous plant growth. The great lesson of the year is, that greater attention should be given in the autumn to the thorough cleaning of the ground.

The clover stubbles are the headquarters of the *Tipula oleracea* for egg-laying, and the legless grubs lie just below the surface, and, except when torpid, require to eat. What is needed is either to kill them at once, which can be done, to a great extent, by paring and burning, or to starve them out before the new crop is put in by thorough cultivation. The grub is very active and feeds on many plants, so that mere common cultivation does but little towards getting rid of it; but if the ground is thoroughly worked, and the rubbish collected and burnt at once, the attack in the coming season has been found to be very much lessened. The soil is thus put in a good state to run the next crop on, many grubs are destroyed by being either thrown up to the birds, burnt, or buried too deep to come up again, and if a sufficient time has been allowed to elapse before putting the new crop in, a very large number will have been starved out. All the reports of careful observers show that farmers have good cause to be thankful for the work done by birds in the destruction of insect pests. Starlings, rooks, and lapwings—all of which are scarcer now than a few years ago, the cold and wet destroying large numbers—are powerful helpers in keeping down these injurious ravagers of our crops. Another pest, which has appeared in unusual numbers during the past two months, is the mangel-wurzel fly (*Anthomyia betæ*), which does harm by its small, legless maggot gnawing away the inside pulp of the leaves between the upper and lower sides. This has, however, but rarely caused any serious mischief in this country, and as the reports of the past week all show that the rains are fast recovering the injured crop, the loss from its ravages will not probably be large this year. Among the other more prominent pests this year is the celery fly and the wheat midge (*Cecidomyia tritica*), the latter being very prevalent in some of the southern and midland counties. Miss E. A. Ormerod will be always pleased to receive from any persons specimens of insects or maggots doing injury to plant life, together with an account of their ravages, whether in the garden or in the field. Successful treatment in any case will be welcomed, and proper forms will be sent to any one for filling in the information, and also a copy of the annual report containing the observations of the year. In Ireland, especially, a few additional observers would be welcomed.—*London Times.*

BATOIDEI, OR RAYS.

BY A. W. ROBERTS.

The rays or skates resemble sharks in their organization, but not in their external form. The body has a round and

FIG. 3.—BARN-DOOR SKATE.

rhomboid form, the sides of which are represented by the large pectoral fins, which are attached to the hind part of the head. The snout is pointed and elongated; the mouth, nostrils, and gill openings are situated on the under side of the body. (See Fig. 3, showing the egg of a blunt-nosed skate, partially cut away, displaying the young skate with umbilical sac.) The narrow and long tail of the rays generally has two dorsal and one anal fin, the latter unequal in its lobes. Their eyes show a very remarkable peculiarity, consisting of a fringed curtain that hangs down from the upper border of the iris, and covers part of the pupil. The eggs of the rays are wider than those of the shark's, have a less transparent case, and resemble flat cushions with long coiled strings at the four corners.

The "torpedo," "cramp fish," or "numb fish" (*Torpedo occidentalis*), the "prickly ray" (*Raia Americana*), the "barn-door" skate (*Raia lævis*), the "spotted ray," "sting ray," "butterfly ray," "cow-nosed ray," and "monk fish," belong to this family, and are more or less common on our coast.

The sharks and the rays come together so closely as regards their eggs and structure that it is hard to determine where the departure or blending of the two families takes place. For instance, take Fig. 2, showing the eggs of the shark or dog fish, common on the British coast, and the eggs of rays common on our coast, Figs. 1 and 3. In each case the eggs are of a softish, horn-like consistence, so that they are not liable to be broken or easily penetrated. The general shape of the egg has been aptly compared to a pillow case with strings tied to the corners or sides, the inclosed pillow being the young shark. The long curling, tendrillous, and silky appendages speedily affix themselves to seaweeds, shells, or other objects, and from their form and material anchor the egg firmly. To enable the little ray or shark to breathe there is an aperture at one end of the egg, through which the water passes in sufficient quantity to renovate the blood. And in order to permit the inclosed fish to make its escape when sufficiently developed, the end of the egg nearest to the shark's head is formed so as to open by the slightest pressure from within. After the newly born skate has left the egg, there is no perceptible external change in the shape, for the egg, being elastic, closes up as before. One of the most common skate eggs found on our outer coast is shown in Fig. 1, life size. This is found of various sizes, and often of various tints, although it is usually of a very dark brown or rich olive green. It will at once be recognized by the illustration given. This egg is the production of one of our largest skates, known as the sharp-nosed skate, and harmonizes well with the strange, weird-like aspect of the creature from which it is produced. If one of these eggs is picked up in the early part of the year, it will usually be found to contain the young of one of these animals, not a very prepossessing creature, but very interesting to students of embryology. Perhaps the reader may remember Hogarth's "Gate of Calais," where a fisher-woman has upon her knees a huge skate, in whose countenance the painter has wickedly infused an expression precisely like that of the storm-beaten, withered old dame who holds it.

EGG OF SHARP-NOSED SKATE.—(*Raia Americana.*)

Another Mastodon.

The remains of a large animal, probably a mastodon, were discovered in an old swamp near Hopestown, Ill., September 18. The tusks are nine feet long, twenty six inches in circumference at the base, and weigh 175 pounds each. The lower jaw with teeth is well preserved. The teeth are perfect, though somewhat worn. One weighs eight pounds, and is twenty-one inches in circumference. Several of the leg bones are in good condition. The thigh bone is two and a half feet long, and the tibia three feet. The ribs and back bone are in bad condition as the back of the animal was only three feet below the surface of the ground.

Rhode Island Scallop Fishing.

The scallop season of Narragansett Bay began September 15. By sunrise the scallop grounds were covered with boats, each carrying from two to four dredges and two men. The lawful limit to each boat is fifteen bushels a day. There was landed at Providence the first day about 350 bushels. Visiting the shops at the landing place a reporter of the *Journal* found scores of men and some women, standing up to long benches with knife in hand, separating the pure white muscle or "eye" from the shells and refuse with two or three motions, which display great dexterity, and are acquired by long practice. The muscle is unusually large and plump this year, so they will average about a gallon to every bushel in the shell. Twelve and a half cents a gallon is paid for cutting out, and an experienced cutter will flip the shells from about two bushels an hour. The ruling price is eighty cents a gallon, but if shippers crowd the market and the weather is warm they bring much less.

Pacific Salmon.

While the habits of many of our valuable food fishes are well known, there is yet much to learn in regard to the salmon, and especially those of the Pacific coast. An English traveler by the name of Pennant was the first to call attention to them, and gave the Indian names to the various species. After him came a German who Latinized the popular names. When the territory came into the possession of the United States other descriptions were given, but as the observations were made at different periods of the year, and as the salmon differ according to season, some thirty species were made where there existed but five. The flesh of the salmon in the spring is of a clear white color, with the advance of the season it changes to pink, then to a deep red, and finally becomes mottled, and in some cases almost black. In the early part of the season the scales are silvery and loose, but later they become embedded and dull, while those on the back disappear. The teeth, from being small and fine, grow large, and sometimes reach half an inch in length. The cartilaginous snout and the lower jaw grow out, while the upper jaw hooks down.

Fig. 2.—Eggs of Dog-Fish.

Of many of the habits of these salmon we are still ignorant, but we know they spawn in fresh water and then go down into the salt. Professor Jourdan says that in April, when the Columbia is high, they appear to be attracted from the ocean, probably by the cooler water of the river. They turn into the river, and as soon as they feel the influence of the current they go right up. Near the mouth of the river, and where the water is the least discolored, they can only be taken by the seine. They take the hook in salt water or in perfectly clear fresh water. Up the Columbia the salmon journey, and are found away up in Montana, and following the Snake and its tributaries they penetrate into British Columbia. The salmon will continue up stream as long as water can be found deep enough in which to swim. At the head waters of the river they often present a pitiable sight. They are frequently found with their heads smashed from contact with the rocks, their eyes knocked out, their fins scraggy, and otherwise bruised and injured. Here, after spawning, as they can go no further, unable to obtain food, they die in large numbers, and very few of them which penetrate thus far ever reach the ocean again. The last month or so that they are running up the Columbia they are unfit to eat, being poor in flesh, often covered with blotches and sores, and generally in a poor condition. There are about one and a half million salmon taken annually in the Columbia River, amounting to about 30,000,000 lb. in weight. It has been feared by some of the large canners on the Columbia that the supply might be diminished from the large number annually taken, but probably enough escape the nets and spawn to keep up the supply. The principal salmon used for canning on the Columbia is the Chinook or spring salmon.

Pond Lilies.

An exchange gives the following information in regard to pond-lily culture. A tub of some kind, some garden soil, and water are all the requirements; a tub may be made from a portion of a cask, and if desired it may be sunk in the ground. Place in the tub good soil enough for the roots, perhaps a quarter full will be sufficient; put in the plant; it is not necessary to plant it, merely pressing the stem into the soil will answer. The big affair which passes for the root is really the stem, which lies along the bottom of the pond. One side of this produces roots which take a strong hold of the soil, as every one who has tried to get up one knows, while buds producing the leaves and flowers are on the upper side. When the tub is filled with water no further care is required during the summer, except to supply water as it may be needed, as it is not likely that the rains will make up the loss by evaporation. Unless the tub can be so protected that it will not freeze solid it should be moved to the cellar at the approach of cold weather. Only enough water need be left in the tub when it is moved as will be needed to keep the soil moist.

Deep Sea Trawling.

In the trawling and dredging operations of the Fish Commissioners' steamer Fish Hawk three different trawls or dredges are used—the beam trawl, the otter trawl, and the harrow dredge. Before the dredges are thrown out the depth of the water is ascertained by a sounding apparatus, a modification of Sir William Thomson's. No depths are ever taken without ascertaining temperatures. The thermometer used is the Negretti and Zambra, which has the advantage of recording temperatures more quickly than the Miller and Cassela. Lieut. Tanner, U. S. N., commanding the Fish Hawk, has devised an ingenious method of reversing the thermometer when it reaches bottom, so that no intermediate temperatures are recorded. The depth being ascertained, the operation taking but a few moments, and the temperature being recorded, dredging commences. The steamer has a reeling engine forward, around the drum of which a steel wire rope, three-eighths of an inch in diameter, is coiled. Two kinds of trawls are used for dredging, the beam trawl and the otter trawl. The beam trawl, which is copied after those used by the English and Dutch fishermen in catching turbot and sole in the German Ocean, is some 16 feet across, with a purse-formed net some 35 feet long, the meshes being about 1½ inch at the beam, and diminishing rapidly in size toward the tail of the net. A boom is rigged out from the foremast, which is at right angles with the ship. The trawl connected with the steel wire is hauled up by steam power and lowered into the water. The steel wire runs through three pulleys, and is attached by a rope to an accumulator, made of a series of rubber disks, which regulate the strain. In order to preclude chance of accident, it being better to lose the trawl than the steel rope, the trawl is fastened to the rope by means of a detacher, which has two jaws to it. If the trawl should catch on a rock and a tug take place, the steel rope being more valuable than the trawl, the attacher unloosens itself. At a strain of 4,000 pounds the trawl would be detached. The steel wire will stand a dead pull of 8,700 pounds. Care is taken to prevent all kinks in the steel rope when winding or unwinding, for a kink diminishes its strength just 50 per cent. The beam trawl is lowered gradually. When the beam touches the surface of the water, it being weighted down on both ends by strap-shaped irons called runners, it sinks parallel with the bottom. Then the vessel is allowed to drift backward, if such be the condition of the tide, or she is moved away from the trawl by reversing the screw. The trawl is then like a big bag, with its mouth wide open, which is drawn dredge-like across the bottom. In a sailing craft, as the luggers, the trawl is worked from the stern, the vessel being kept under easy sail. After the trawl has remained down some 20 minutes it is hauled up. As the hoisting engine is on the upper deck, it would be inconvenient to dump what is taken in the trawl. As the net comes up, the top being suspended from the wire rope from the beam, the tail of the bag is opened on the lower deck, the end of the purse being unloosened, and the varied contents pour into a trough, which has a series of wire bottoms of various degrees of fineness. About 40 minutes are sufficient to make a dredging.

The otter trawl works somewhat in the same way as the beam trawl, only instead of a transverse beam of wood or iron, the sides are held by two pieces of heavy wood, in shape something like center boards. These are weighted at the bottom with iron keels. The net is about the same shape as the beam trawl. The two weighted pieces of wood sink the net, the net itself having floats of cork above and leads below. As the net is drawn under water by the movement of the vessel, the two pieces separate, flaring out. As the net is hoisted the pieces of wood close up, and the mouth of the bag is shut. The advantage of the otter trawl is that it is less costly and more easy of storage, being the form usually employed by English yachts. It is more convenient for dredging in shallow water, but is not, perhaps, quite as certain in its effects as the beam trawl.

A third kind of dredge is used for clay bottoms and only for scientific purposes; this is the harrow dredge. In using this the object is to tear up the bottom some feet in advance of the bag, so that the forms embedded in the bottom may be secured. There is an iron harrow, which is in front of a net which is covered with canvas to protect it from tearing, the mouth of the net being extended by an iron frame. The possible use of the first two trawls by our fishermen is a fact which ought not to be overlooked. It is true that at present we do not have on our coast any varieties of flat fish of as good quality as those caught in the German Ocean. But still the contingency might arise when such nets could be found serviceable. The pole flounder, which is by far the finest variety of flat fish we have in our waters, can only be caught to advantage by means of trawls, and when once the merits of this fish have been determined, there is no doubt that our fishermen will profit by such experiences as the United States Fish Commission has given them.

Swarming Extraordinary.

D. N. Kern relates in the *Ohio Farmer* the following experience with a swarm of Italian bees: The first swarm came out May 5, and was put in a hive filled with comb. On the 19th of May the second swarm came out, and was hived with a weak swarm. On the 20th the third came out, and was hived with the second and the weak swarm. On the 21st the fourth swarm came out. Mr. Kern caught the queen and killed it, and put the swarm back to the old colony. On the 23d the fifth swarm came out. He caught two queens and killed them, and put the swarm back again. On the 24th, at nine o'clock A.M., the sixth swarm came out. He caught two queens again and killed them, and put the swarm back again. The same day, at three o'clock P. M., the seventh swarm came out again. This time he hived them in an old straw hive, and set them on top of the old hive. In the evening of the 25th he shook them down in front of the old hive again, and that settled for the time the swarming fever of the old hive. But on the 26th of June, the first young swarm threw out a very large swarm, and on July 3d threw out a second swarm, and about five minutes later a swarm came out of the old hive again. He hived both swarms together and sold them for $200 cash. All these swarms made 235 pounds of comb honey.

New Substitute for Rubber.

This artificial composition, which answers the purpose of genuine caoutchouc or gutta percha, can be employed, according to Dankworth and Sanders, of St. Petersburg, either alone or in connection with other resinous substances. According to *Ackermann's Gewerbezeitung*, this new product affords an inexpensive means for a perfect isolation of wires for electrical purposes. The composition is elastic, tough, not so sensitive to external influences as caoutchouc or gutta percha, and is not injured by high pressure or high temperature. It is prepared in the following manner:

A quantity of coal tar oil, or equal parts of coal and wood tar oil, which is to constitute a third part of the whole mixture, is poured into a large kettle, together with an equal quantity of hemp oil, and is heated for several hours, either over steam or an open fire, to a temperature which lies between 252° and 288° Fah. (it should not exceed the latter), until the mass becomes so ductile that it can be drawn in long threads, and the remaining third, consisting of a quantity of linseed oil, which has been thickened by boiling, is then added.

With this composition from five to ten per cent of ozokerite and some spermaceti should be mixed. The mass is then heated again for some hours at the same temperature as above, and finally from seven to twelve per cent of sulphur are added. The mixture thus obtained is cast into forms and treated the same as caoutchouc.

The proportions of the three oils may be slightly varied according to the practical purposes for which the composition is to be used.

Wood Products of Norway.

The *Building News* (London) states that a great revival has lately taken place throughout Norway in all departments of the timber and planed-wood trades, which have suffered severely from a protracted depression. The wood pulp manufacture, however, has fared better, the demand from Great Britain and France being persistently on the increase. At the commencement of the year there were 21 factories at work, the production for the last three years being as follows: 1877, 295,700 cwt., value £78,300; 1878, 386,482 cwt., value £96,000; 1879, 400,000 cwt., value £90,000. Although the production in 1879 exceeded that of the previous years, prices were lower, from the great local competition; but as esparto grass has risen in value, it will very soon favorably influence the price of wood pulp, the more as the English paper makers contracted pretty largely for paper pulp during the winter, to the amount of 2,000 tons in excess of the ordinary demand. The wood pulp used in England contains about 50 per cent of moisture, but the French paper makers prefer having it air-dried, containing only 8 per cent. There are also four mills employed in making millboard from paper pulp. These are used for band-boxes, and are all sent to England.

Fine Linen.

According to the *Building News* a piece of linen has been found at Memphis containing 540 picks to the inch, and it is recorded that one of the Pharaohs sent to the Lydian king, Crœsus, a corselet made of linen and wrought with gold, each fine thread of which was composed of 360 smaller threads twisted together! The ancient Egyptians wove a fabric called the "linen of justice," or "justification." So beautiful and valuable was it that it was esteemed the most acceptable offering to the "Restorer of Life." A few hand looms can still be seen at work in the Eastern bazaars of Cairo, the cloth woven in which rivals in texture, color, and design the finest glass screens of Munich.

Correspondence.

Fire Apparatus in Cities.

To the Editor of the Scientific American:

In our large cities, when a building is discovered to be on fire, any one having the required key opens the door of the nearest of the little iron fire alarm boxes secured to the telegraph poles, giving an electric signal indicating the location of the burning building. This signal is transmitted to the fire department stations, where but a moment before mild looking horses were quietly munching their feed, and a general air of peace prevailed among both horses and men. But at the sound of the signal a scene of the wildest methodical activity prevails. Of their own accord the horses hasten to their places in front of the steam fire engine; one man lights the previously arranged fuel under the boiler of the engine; another harnesses the horses; the driver springs to his seat, grasps the reins, the station doors are opened, and away they start. All this within about seven seconds after the sound of the signal. Arriving at the fire the engine's pump is connected by hose to the nearest hydrant; a hose carriage is driven alongside and lays a hose from the engine to the burning building; by about the time a nozzle is coupled to this hose the engine has sufficient steam to commence pumping; the hose fills out roundly, and a stream of water is conducted to the burning building. And so with each steam fire engine that has been signaled; men with ladders climb with their hose to the roofs of the burning and adjacent buildings to secure advantageous positions for conducting the water; and if the burning building is of only ordinary size and combustibility, the fire is very soon conquered. But in case the fire occurs in a large warehouse stocked with combustible merchandise, and gains considerable headway before it is discovered, which is frequently the case with our present iron shutters, it may then become startlingly apparent that the inch and a half or two inch streams of water are unable to speedily conquer the element. Recently the writer happened to be in a good position to view a fire of this kind. It appeared as if the streams of water were almost entirely evaporated in passing through the flames, that very little water reached the source of the fire, and that the utmost exertions of the firemen were required to save the neighboring warehouses, and possibly the whole river front of buildings, from destruction. It occurred to me, as I watched the flames streaming high in the air, that in such a case a fire apparatus capable of throwing a stream of water four or eight inches in diameter to a distance of five hundred feet, when directed at an inclination of 45°, was needed. Such an apparatus would have to be in connection with several of the fire hydrants now in use in order to receive sufficient water. Or perhaps the delivery hose of several of the steam fire engines connected to one large swivel nozzle mounted on wheels, and planned similar to those used in the gold regions for washing down auriferous banks of earth, would answer. Such a stream, by reason of its weight and solidity, would pass through the flames to the source of the fire, and thus prove more effective than several small streams. It appears that each small stream of water acts on the principle of an ejector carrying with it by friction fresh air, thus in a measure aiding combustion. The safety and prosperity of our cities are so dependent upon our fire departments, that any means for rendering them more efficient is of vast importance, and successful inventions in this line would be pretty sure to afford inventors a rich harvest.

L. L. D.

New York, October 6, 1880.

RECENT INVENTIONS.

An improvement in grain separators has been patented by Messrs. William S. Bright and Samuel Thomas, of Letart, W. Va. The object of this invention is to furnish grain separators so constructed that the light grain, the cheat, and chaff will be separated from the grain by an air blast, and the cockle and other small seeds will be separated by screens.

An improved filter has been patented by Mr. Louis R. Sassinot, of New Orleans, La. This invention relates to a means for filtering the water collected in cisterns of ordinary construction in order to render it fit for drinking, cooking, and other purposes.

An improved stove truck has been patented by Mr. Hiram Shuman, of Buck, Pa. The invention consists in combining with a platform parallel locking shafts supported on fixed and swiveled casters, and an intermediate shaft parallel to the shafts, levers being attached to the latter and connected with the intermediate shaft.

An improved elevator for barrels, etc., has been patented by Mr. Latham W. Greenleaf, of Terre Haute, Ind. This is an improvement on the elevator for which Letters Patent No. 220,137 were granted to the same inventor September 30, 1879, the object being to better adapt them for use in elevating and lowering barrels and other articles from one floor to another in storehouses, warehouses, and other places, and which shall be so constructed as to load and unload themselves while in motion.

An improvement in stone crushers has been patented by Mr. Charles G. Buchanan, of Brooklyn, N. Y. The object of this invention is to produce a parallel and sliding motion upon the lower portion of the crushing plates for the purpose of increasing the pressure, and, if desired, reducing the product to a greater degree of fineness.

TIN PLATE INDUSTRY.—THE PROCESS OF MANUFACTURE.

In the last issue of the London *Iron Exchange* received at this office is an interesting history of the manufacture of tin plates from about the year 1600 up to the present time. Omitting the historical portion of the writer's account, we extract from the article a description of the methods now employed in the manufacture of this useful article.

The British Association have recently visited the Dyferyn Iron and Tin Plate Works at Swansea, situated on the river Tawe, with a view of informing themselves regarding the practical workings of this important industry. The same association met at Swansea 32 years ago, since which time great advances have been made in the processes of manufacture. From the 40 mills now running within a radius of 3 miles in the Swansea valley about 20,000 boxes of finished tin plate are turned out weekly, or 1,000,000 boxes annually, which is estimated to be equal to about one-third of the entire export.

But how tin plates are made is information likely to most interest the reader:

In the first place, says the writer, we have what is termed bar iron, several feet long, about 7 inches wide, and from ½ to ⅝ of an inch in thickness, rolled according to the plates required at so many pounds per foot. It is cut in what may be termed a jack-in-the-box or steam shear, say about 19 pounds, to a piece which will eventually be rolled into 16 sheets of 20 inches long by 14 inches wide, 112 of such sheets forming a box, and weighing when tinned nearly 1 cwt.

This piece of iron is first placed in a reverberatory furnace, heated to redness, put through the chilled rolls, and rolled in what is termed thick, five times; reheated and rolled in singles twice; doubled, reheated, and rolled, three times; doubled, reheated, and rolled, twice; doubled, reheated, and rolled in eights, twice, until they are stretched out to the required length and thickness. The length of the bar exceeds by about one inch the width of the sheet to be made, so as to allow for the shearing process, and the bar is therefore rolled with its axis parallel to that of the rolls. Great attention is necessary in the construction and management of the mill furnaces, so that the heating of the bar and sheet for rolling may be effected with the utmost regularity, and without the formation of scale on the surface of the bars or sheets; for when scaling takes place from the draught in the furnace being too keen or the heat raised too high, the quality of the iron is injured; the scale, if subsequently rolled into the iron, leaves a rough surface on the plates in the after process of separating and pickling. The plates are then sheared, and the rough edges taken off. The iron of 19 pounds or thereabouts makes 16 sheets, which, being cut in half, leaves 8 sheets in a piece closely wedged. Girls with small iron hatchets open or separate them. They are then termed black-plate. From one ton of bar iron about 16¾ cwt. of black-plate is made; the loss is termed shearings, and is worked up again in the forge fineries. The plates are next sent to be pickled, *i. e.*, immersed in heated dilute sulphuric acid, known as oil of vitriol.

This process is done by aid of a patent, known as Hutchings' patent pickling machine. The plates are placed in a brass cradle or receptacle, lifted by a hydraulic, then dropped down into a round wooden or lead tank containing the o. v.; the cradle is then made to revolve by means of steam power, to enable the liquid to rush between the sheets, which revolution is retained. They are lifted again by the hydraulic, dropped into a tub, a little apart from the last, containing water only, the cradle revolving as in last tub, so that the water may rush between the sheets to cleanse or wash away all trace of the acid, when taken up again the plates are clean and bright as silver. They are next subjected to a bright red heat, which lasts from 12 to 24 hours, in closed iron annealing pots in a reverberatory furnace; they are well covered on the top to prevent the plates from being burnt; the heat is kept as high as it can be without softening them to such a degree as to cause them to stick so fast together as to prevent their separation when cold.

They next pass singly through cold rolls, three, four, or more times, as may be deemed requisite. These rolls are highly polished, and must be set in accurate order to give the plates a perfectly flat set and well polished surface. Again they are annealed or softened at a lower temperature than the first, as their surfaces would be damaged by being in any degree stuck together. Pickled again as before, excepting that the liquid is considerably weaker than previously, placed in cast iron troughs containing clean water renewed by a stream constantly flowing through, they are then taken in hand singly, and scoured if necessary with sand and hempen pads before being delivered to the tinman.

Now comes the last process. The sheets are iron only so far. They next reach the tin house, and are placed in a trough containing clean water, ready for the tinman, as he is termed, who then picks them up and puts them singly in a grease pan containing palm oil, to soak, and after being there for a short time the tinman places the sheets in a large iron pot containing molten tin, with a covering of palm oil. Here it unites with the tin, to which it has a strong affinity. When he has performed his part the plates are handed over to the next man, called a washman, whose pot contains pure molten tin; after they have soaked in his pot a little, he raises them with a tongs on to the hob as he requires them, brushes the surface of both sides of each sheet, and after dipping them into another pot containing molten tin again, they are sent through rolls which work in a large pot containing palm oil, and the speed at which the rolls move regulates the quantity of tin to be put on each sheet. They are afterward raised from the rolls (under which they have been passing) by a youth, called a riser, handed to two young women, who rub them in bins or boxes containing bran, one after the other, which takes off the grease; another girl, called a duster, gives them a further polish with a skin duster, and takes them to the assorting room, where every plate passes inspection, and, if not up to the mark, is sent back for rectification. After passing through that ordeal they are counted and weighed by young women, made up into boxes according to the different sorts, handed to boxers or packers, who pack them in elm boxes, marked by branding irons as per order, and finally placed in the railway truck to be forwarded to their various destinations. It may be a surprise to some to know that a tin plate passes through about thirty hands from the bar to the railway truck, but is handled no less that 105 times. Such is a simple account of tin plate making.

MECHANICAL INVENTIONS.

Mr. Elijah Cravens, of Osage Mission, Kan., has patented an improvement in the class of automatic car couplings in which each drawhead is constructed with a horn and provided with a pivoted draw bar or clevis, which, when two cars meet, drops over the horn on the opposite draw head and thus locks the cars together. The improvements relate to details of construction and a peculiar combination of the various parts, which render it practical and efficient.

Mr. Charles A. Tucker, of Brooklyn, N. Y., has patented an improved nut lock, designed especially for securing nuts on bridge bolts, carriage bolts, and the like.

Mr. Frank P. Simonds, of Natick, Mass., has patented a simple device for treeing boots, which is rapid and efficient. The device operates by two eccentrics, which are oppositely arranged in respect to each other, and are connected with a strap which is drawn over the boot on the tree with a reciprocating motion.

An improved barrel making machine has been patented by Messrs. David Murray and Thomas W. McGregor, of Rushford, Minn. The object of this invention is to provide in a single machine the several mechanisms and devices for trussing and working the ends of barrels, kegs, etc., preparatory to receiving the heads.

Mr. Albert T. Bleyley, of Conception, Mo., has patented a car coupling, so constructed that cars of the same height or different heights will couple themselves when run together, and which can be uncoupled from the tops of the cars.

Mr. William Brown, of Fort Cameron, Utah Ter., has patented a hollow iron railroad tie, of rectangular cross section, having a concave bottom, and having end ledges formed on its top to prevent the spreading of the rails.

Researches on Batteries.

The author has found two methods for obviating the inconvenience that chemical action in batteries is never entirely arrested when the circuit is open. One of these methods is based upon the absorbent power of animal charcoal, and is applicable to all the cases where the depolarizing liquid is a metallic salt. He has constructed a sulphate of copper battery, in which the copper solution cannot be diffused through the zinc. He takes an ordinary Calland element, at the bottom of which is placed a stratum of powdered copper sulphate, covered with bone-black, washed, and powdered. The zinc is placed in the upper part of the jar, and is separated from the copper sulphate by the bone-black. The element thus arranged resembles a Minotti battery, in which bone-black is substituted for sand. The zinc remains entirely unaffected. The second method, more general than the first, consists in taking as a depolarizing body a liquid which gives a precipitate on mixture with the liquid which attacks the zinc. The diaphragm separating the two liquids is thus rendered completely impermeable. The precipitate formed in its pores must be a conductor of electricity and must be capable of electrolysis.—*A. D'Arsonval.*

Improvement of the Bunsen Battery.

This improvement, made by Mr. Azapis, consists chiefly in replacing the acidulated water in which the zinc is immersed by a solution of about 15 per cent of cyanuret either of potassium, of caustic potash, of sea salt, or of ammonia salts. The liquid in the porous vessel which contains the carbon plate remains the same as usual. This improvement has the advantage that, while the intensity of the current is the same as in the Bunsen element, the zinc plates do not need to be amalgamated, and the consumption of zinc is considerably less, while the constancy and the durability of the current are remarkable. A battery improved in such a manner, which consisted of 25 elements, and in which ordinary ammonia salts were employed, was used without interruption for four days in succession, and during the evening for the purpose of producing an electric light. Another advantage of the battery is that it gives out very little odor.

The Exportation of Apples.

Over 40,000 barrels were shipped to Europe from this and other American ports during the last week of September, and large quantities are expected to follow. It is a year of extra bearing in most parts of this country, while in England and other parts of Europe the apple crop is a failure. It is estimated that half a million barrels will be exported this season. Two years ago—a good apple year—333,000 barrels were shipped to Europe.

AMERICAN RAZORS.

Among the industries which have been transplanted to this country during recent years none has had greater prejudice in favor of foreign products to overcome, or has started from a higher level of practical excellence, than the manufacture of fine razors.

For twenty years or more the establishment of Mr. J. R. Torrey, 34 Southbridge street, Worcester, Mass., has had a national reputation for the variety and quality of the razor-strops it has turned out. More recently Mr. Torrey has formed with his son and Mr. Joseph Turner, a practical razor maker, the J. R. Torrey Razor Company, and organized under the most favorable conditions an establishment for the production of razors of the finest quality.

Here the steel in the bar, the horn and ivory in the raw state, are taken in hand, blades are forged and ground, handles are made, and every step of the work of producing finely finished razors is going on under the same personal supervision. The making of the paper cases, their lettering in gold, and the etching of the razor blades, are all included in the work of the establishment. Hence our American cutlers are no longer obliged to send to Europe for razor blanks and handles, as they are now made of equal excellence on our own soil.

The methods and processes employed at Sheffield have been greatly improved upon, and the J. R. Torrey razors have taken high rank in competition with the best that Europe produces.

CREMATION OF THE DEAD.

Exactly how to dispose of the ashes of the dead in the most satisfactory manner, after cremation is accomplished, is still a question. The ancient practice was to deposit the ashes in a funeral urn, to be preserved in a tomb or other sacred place. This is also the modern custom. But if tombs are to be required then there is not much need for cremation, as the corpse may as well be buried in the tomb without cremation.

A recent American patent consists in providing a parlor bust of the deceased, cut in marble, and in making a hole in the back of the bust, wherein the ashes are to be deposited after cremation of the body.

A further improvement, suggested by one of our lady correspondents, is to prepare a wet mixture of cements for artificial stone or marble, and sprinkle the ashes of the deceased into the mixture, which is then to be cast or pressed into the form of busts, statuettes, or other objects. In this way various members of a family might possess enduring portions of the ashes of the departed one.

Pneumatic Tubes supersede Cash Boys.

The incessant calls for cash boys, which formerly made shopping in our larger establishments so wearisome, if not exasperating, were silenced and the terrors of shoppers greatly mitigated by the introduction of electric calls. An enterprising Philadelphian has gone a step further, and displaced the dusty skurrying of cash boys and cash girls by a system of pneumatic tubes. Under the new system an inspector and wrapper is stationed at each counter, who will receive with the money and goods the seller's check. While the goods are being wrapped up the cash with the proper vouchers will be transmitted to a centrally located cashier, who will return the change through the proper tube. There are two such tubes leading from each counter to the cashier's inclosure. One of the tubes is to carry the money to the cashier, and the other is to return the change and accompanying check to the counter again. The "carriers" which work inside of the tubes are little cylindrical boxes of sheet steel, lined with green baize, and protected at each end by diminutive felt cushions. Each carrier is of the exact diameter of a silver dollar, and is capable of holding thirty of the latter pieces or a much larger sum. By means of a steam engine and exhaust pump in the cellar, with proper attachments leading therefrom, the air is being constantly exhausted at the cashier's end of the tube and at the counter end of the tube of each pair; and when a "carrier" is placed in the mouth of either tube, it is immediately drawn to the other end, and is there delivered automatically by an apparatus devised for the purpose. This system not only saves time and noise, but the wages of an army of boys or girls, besides discharging a large amount of fresh air into the building, greatly improving the ventilation.

The Factory Laws in Switzerland.

A short time ago the Swiss Government enacted laws restricting the time during which the workmen might be employed in factories, and forbidding the employment of children under 15 years of age. It appears now that this law works so injuriously that the State counsel is embarrassed about it and advocates its abolition, as many Swiss manufacturers have founded new establishments abroad, while others are removing their old plant entirely in order to escape the restrictions imposed, especially the limitations of the hours of labor, contending that the capital invested does not yield sufficient returns when the factories have to be idle for 14 to 15 hours out of every 24. This objection could be easily met by employing two sets of workmen, each working 8 hours a day; while with three sets of hands the factory could be kept going night and day.

The restricting laws would ere this have been abolished were it not that the working classes are agitating against its repeal. The result of the struggle in little republican Switzerland is looked upon with interest.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

NEW BOOKS AND PUBLICATIONS.

THE VICTORIA REVIEW. Published at Melbourne, Australia, by the Victoria Review Publishing Company, and edited by H. Mortimer Franklyn, Esq.

This is one of the best magazines that comes to this office from any country. The Victoria *Review* is published monthly, and its contributors are among the most able and profound writers of the day. The July number, just received, contains papers from several eminent writers, and to better convey an idea of the nature of the publication we append a list of the writers and the subjects of their several contributions in the July issue: Lewes' History of Philosophy, by C. Hamilton Bromby (Tasmania); Nineteenth Century England, by the Rev. W. H. Fitchett; A Few Words about Béranger, by John F. Perrin (New Zealand); Proportional Representation, by Guido Padelletti (Florence); Modern Biology, by Edward B. Sanger (Adelaide); The Place of Religion in Fictitious Literature, by Miss C. H. Spence (Adelaide); A Venetian Dramatist, by James Smith; Sermons on Genesis by Dr. Bromby, by the Very Rev. the Dean of Melbourne; Goethe's "Faust" and Byron's "Manfred," by R. Colonna-Close; The Affairs of Europe, by Emilio Castelar (Madrid); A Menacing Comet, by Richard A. Proctor; The Decay of Matrimony in Victoria, by the editor; The Contemporary Thought of Great Britain, Europe, and the United States. We would like to see this *Review* more widely circulated than it has heretofore been in this country, for it merits an extensive subscription list, if it is published in a remote English colony on the other side of the globe. We would, therefore, recommend it to the patronage of students and all thoughtful persons, who, we are sure, will be both interested and benefited by receiving the publication regularly. D. Appleton, 3 Bond street, New York, receives subscriptions and furnishes the numbers to their subscribers as soon as they are received.

MANUAL OF THE RAILROADS OF THE UNITED STATES FOR 1880. By Henry V. Poor. New York: H. V. & H. W. Poor. 8vo, cl., pp. 1077. $5.

Poor's Manual grows fatter and more widely useful every year. This the thirteenth annual number gives the mileage, stocks, bonds, cost, traffic, earnings, expenses, and organizations of something like 1,400 railroads, with an appendix containing a full analysis of the debt of the United States and of the several States.

BOLETIN DE LA SOCIEDAD DE GEOGRAFIA Y ESTADISTICA DE LA REPUBLICA MEXICANA. Vol. V. Mexico, 1880.

The present issue of this valuable scientific publication, which we have just received from the society, embraces the first three numbers of the fifth volume (third series). The articles, as usual, pertain to a wide range of scientific subjects, are very interesting, and give evidence of conscientious study and much painstaking labor on the part of the authors. The contents, in addition to the society's proceedings, embrace contributions from Sr. Fernandez on the "Determination of the Length of the Seconds Pendulum in Mexico at 2,283 Meters above the Sea Level;" Sr. Leal on a "Study of Mortality in the City of Leon de Aldamas;" Sr. Ramirez on the "Mines and Mineral Productions of Guadalcazar in San Luis Potosi;" Sr. Reyes, "Meteorological Observations;" and Sr. Arechiga, "Note on the Saltpits of Sayula." In addition to these signatures, there are various notes and translations by the editors, making altogether a collection which well sustains the high standard reached by the preceding volumes. We congratulate the Mexican Society of Geography and Statistics on having so many earnest workers in its ranks, and wish it every success.

ELEMENTARY TREATISE ON ELECTRIC BATTERIES. From the French of Alfred Niaudet. Translated by L. M. Fishback. New York: John Wiley & Sons. $2.50.

Telegraphers, and all others who have to do with or desire to study the nature and management of the various types of electric batteries, will find M. Niaudet's book very serviceable. The translator's fitness for his task is generally vouched for by the capable electrician of the Western Union Telegraph Company, Mr. George d'Infreville.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) L. H. C. asks: 1. How many two quart Bunsen cells will be necessary to run a Duboscq's electric light regulator? A. About 50. 2. Is the following a proper formula for the battery fluids: for porous cell—1 gallon water, 1 lb. bichromate of potash, 1¾ parts sulphuric acid; in outside jar—1 part sulphuric acid to 12 of water (by measurement)? A. Yes.

(2) D. H. F. asks: Will a dynamo-electric machine produce a continuation of sparks between two or more electrodes in the circuit, or must an induction coil be placed in the circuit? A. An induction coil will be required. 2. What is the best material to make the electrodes of? A. Platinum. 3. Why are the buttons on telegraphic instruments platinum tipped? A. Because it is refractory and unoxidizable. 4. Does not every electro-magnet placed in an electric circuit act as so much of a break or resistance coil to the current? A. As so much resistance.

(3) H. S. writes: I wish to build a cistern to hold twelve thousand gallons. It can't extend over five and a half feet below the surface, on account of the quicksand. What shape and dimensions are required to secure the greatest strength in walls? How many brick will it take to build it? A. A cistern twenty feet diameter and five feet deep will hold the quantity named. The number of bricks cannot be given, without knowing the thickness of the walls, and this will depend somewhat upon the nature of the soil backing the walls.

(4) C. W. H. asks: 1. On what part of the axle of a buggy wheel is the greatest friction while the vehicle is in forward motion? A. It depends upon the surface over which the wheel is traveling, the size of the wheel, and the load. Generally a little forward of the vertical line. You may determine this point in any given case by examining an axle long in use, and see where has been the greatest wear. 2. If a wheel could be suddenly freed from its axle while the vehicle was in motion, would the wheel run on with accelerated motion—in other words, if the speed of the vehicle continued the same, could the free wheel pass it? A. No.

(5) G. S. H. writes: 1. I wish to build a small steam yacht; I wish it entirely for speed. The boat must be sufficiently large to carry 500 lb., besides boiler and engine. I have an engine, 2 inch bore by 4 inch stroke. What size boiler and boat will I require, and the speed I can make with same? A. Length 18 to 20 feet by 4½ feet beam, by 28 inches deep; engine, 2 inch cylinder by 4 inch stroke; boiler, upright tubular, 22 inches diameter by 40 inches high; tubes, 1 inch or 1¼ inch diameter by 24 inches long.

(6) C. W. asks: 1. Would it not be as well in making the dynamo machine described in SUPPLEMENT, No. 161, to wind the wire round the armature instead of lengthways? A. No. 2. Would the machine be strong enough to magnetize small bars of steel? A. When made according to directions given in the SUPPLEMENT, yes.

(7) J. N. J. asks: Will it require a stronger dam or dike to hold a large body of water than it does to hold a very small body? A. Leaving out of consideration the effect of waves, the depth being the same in both cases, there would be no difference in the strength of dam required.

COMMUNICATIONS RECEIVED.

On Boiler Explosions. By L. H. K.
On Hydraulic Cements. By J. D.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending September 21, 1880. AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Grate for stoves and furnaces, I. Hayes 232,494
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TRADE MARKS

Cigar, cigarette, plug, and fine-cut smoking and chewing tobacco, and snuff, Buchanan & Lyall .. 8,044
Flour, patent process, J. N. Matthews 8,043
Medical compound for the cure of blood and liver maladies, certain, G. H. Lohman & Co. 8,046
Medicinal preparation, T. Morley 8,042
Starch, T. Kingsford 8,041
Tobacco, plug and fine-cut smoking and chewing, Buchanan & Lyall 8,045

English Patents Issued to Americans.

From September 17 to September 24, 1880, inclusive.

Bran packing machine, W. S. Williams, San Diego, Cal.
Carbureting machine, M. M. Jackson, Providence, R. I.
Cap tube, J. C. Vanloke, New York city.
Dust collecting machinery, G. T. Smith et al., Jackson City, Mich.
Electric lamp, T. A. Edison, Menlo Park, N. J.
Exercising apparatus, J. H. Weeks, New York city.
Explosive compound, M. Tschirner, San Francisco, Cal.
Iron and steel, manufacture of, C. M. Dupuy, Philadelphia, Pa.
Iron coating, J. B. Jones et al., Brooklyn, N. Y.
Nut for axles, A. W. Winter, San Francisco, Cal.
Pencil sharpener, C. J. Cohen, Philadelphia, Pa.
Plow, C. E. Sackett, Wayne Township, Pa.
Printing press, Gilman Vertical Press Co., Boston, Mass.
Railway switch, J. S. Williams, Riverton, N. J.
Refrigerating apparatus, L. Allen, New York city.
Safety valve, H. G. Ashton, Somerville, Mass.
Sewing machine, D. Mills, Philadelphia, Pa.
Spring scales, C. C. & S. B. Parker, Brooklyn, N. Y.
Steam generator, D. Davison, New York city.
Steam, heating and superheating, S. N. Carvalho, New York city.
Ventilating apparatus, D. Groesbeck, New York city.

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Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

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THE NEW YORK BELTING AND PACKING COMPANY
CAR & WAGON SPRINGS
Made by our processes are thoroughly efficient and practically indestructible.
37 & 38 PARK ROW, NEW YORK.

SWITZERLAND.
EDW. DALLWIGK, Geneva, agent and importer for American goods, industries, and novelties of all kinds. Manufacturers required to send price lists or samples, if possible. First-class references or cash payment.

NEW CHAMPION
Single Breech-Loading

SHOT GUN.
Retail Price.—Plain Barrels, 12 bore, $14.00; Plain Barrels, 10 bore, $15.00; Twist Barrels, 12 bore, $17.00; Twist Barrels, 10 bore, $18.00. The frame and trimmings of all these guns are Nickel Plated. This gun possesses many advantages over any single breech-loading gun yet produced in this country. It has a patent side-snap action with a safety attachment, by means of which it can be opened only when the gun is at half-cock, thus ensuring perfect safety in loading. The workmanship and materials used are first-class; no gun being allowed to leave the factory until it has been thoroughly inspected. We take great pleasure in offering this gun to the public, and feel safe to say it is the best American Single Breech-Loader yet produced. Send stamp for Illustrated Catalogue of Guns, Rifles, Revolvers, and Skates. Address JOHN P. LOVELL & SONS, Gun Dealers, Boston, Mass.

Mill Stones and Corn Mills.
We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SONS, Buffalo, N. Y.

Pyrometers. For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc.
HENRY W. BULKLEY, Sole Manufacturer, 149 Broadway, N. Y.

KNABE PIANOFORTES.
Unequaled in
TONE,
TOUCH,
WORKMANSHIP, &
DURABILITY.
WAREROOMS: { 112 Fifth Avenue, New York. 204 & 206 W. Baltimore St., Baltimore.

WM. A. HARRIS,
PROVIDENCE, R. I. (PARK STREET),
Six minutes walk West from station.
Original and Only builder of the
HARRIS-CORLISS ENGINE
With Harris' Patented Improvements, from 10 to 1,000 H. P.


Our new Stylographic Pen (just patented), having the duplex interchangeable point section, is the very latest improvement. THE STYLOGRAPHIC PEN CO., Room 13, 169 Broadway, New York. Send for circular.

The Asbestos Packing Co.,
Miners and Manufacturers of Asbestos,
BOSTON, MASS.,
OFFER FOR SALE:
PATENTED ASBESTOS ROPE PACKING.
" " LOOSE "
" " JOURNAL "
" " WICK "
" " MILL BOARD.
" " SHEATHING PAPER.
" " FLOORING FELT.
" " CLOTH.


"RELIABLE"
Engines a complete success. Prices still 40 per cent. below those of other makers. Unequaled for efficiency, simplicity, and durability. Prices from $250 for 10 H. P., to $400 for 30 H. P. All complete, with Governor, Pump, and Heater.
Address, for circular,
HEALD, SISCO & CO., Baldwinsville, N. Y.

DOUBLE PITMAN PRESSES.
STILES & PARKER PRESS CO., Middletown, Ct.

Shafts, Pulleys, Hangers, Etc.
Full assortment in store for immediate delivery.
WM. SELLERS & CO., 79 Liberty Street, New York.

SASH DOVETAILING MACHINE.

Planers, Moulding Machines, Mortisers and Borers, Tenoning Machines, Blind Rabbeting Machines; also, a large variety of other wood working machines, manufactured by
LEVI HOUSTON, Montgomery, Pa.

"The 1876 Injector."
Simple, Durable, and Reliable. Requires no special valves. Send for illustrated circular.
WM. SELLERS & CO., Phila.

H. W. JOHNS' ASBESTOS
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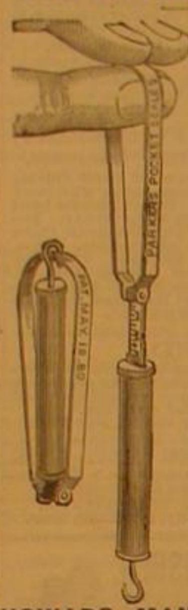
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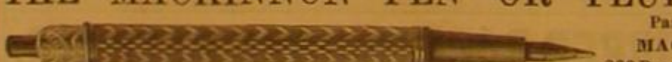
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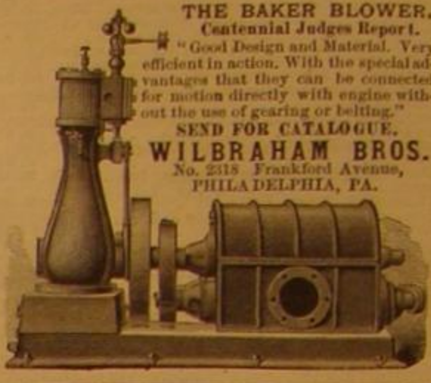
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