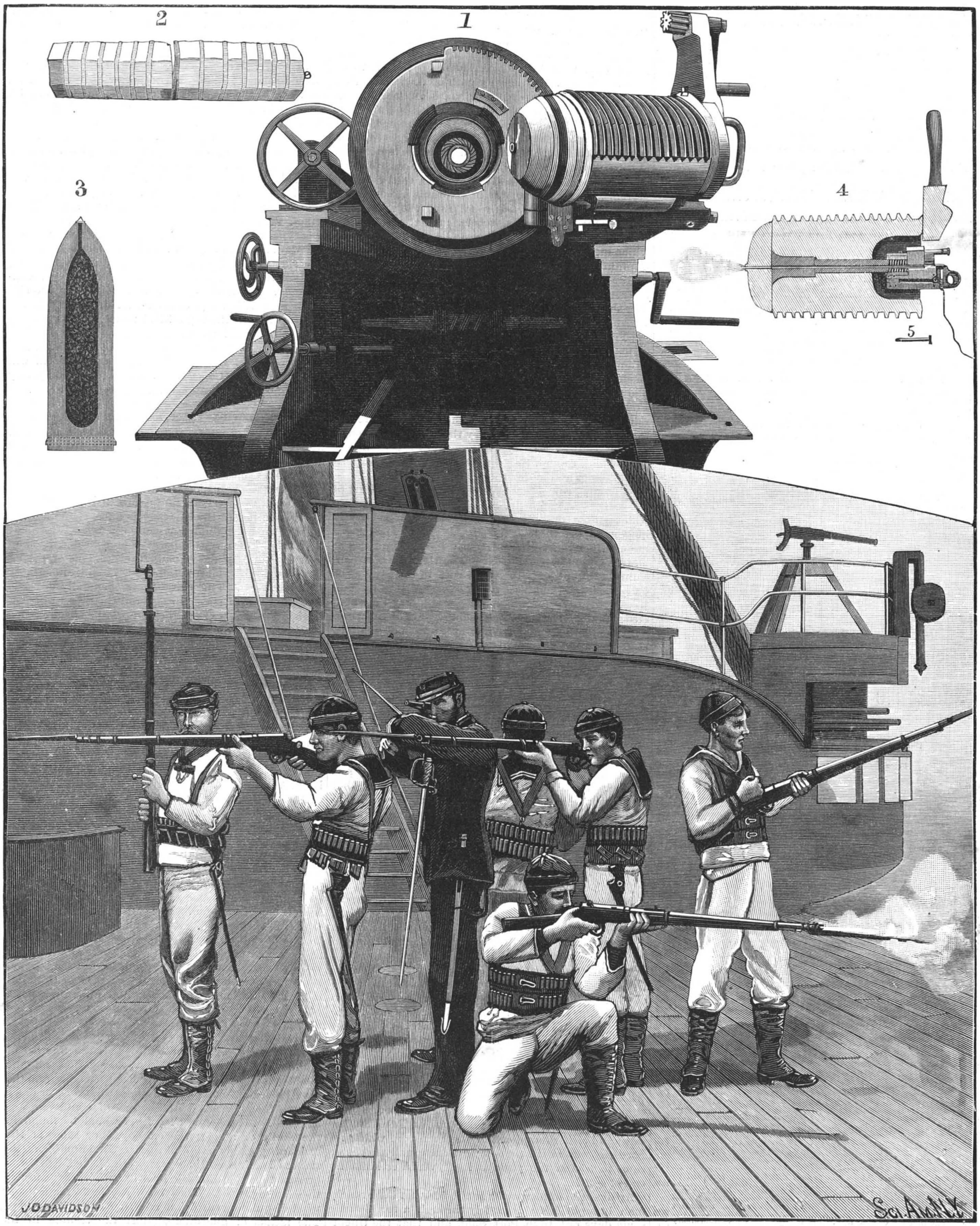
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LVII.—No. 3. [NEW SERIES.] NEW YORK, JULY 16, 1887. [$3.00 per Year.



THE U. S. S. ATLANTA.—A DRILL WITH MAGAZINE GUNS.—FIRING MECHANISM OF THE GREAT GUNS.—[See page 36.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, JULY 16, 1887.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 602,

For the Week Ending July 16, 1887.

Price 10 cents. For sale by all newsdealers.

WORK ON THE PANAMA CANAL LIKELY TO STOP.

Recent reports from Panama indicate that work will shortly cease on the line of the proposed canal, and, unless the difficulties in the way have been greatly exaggerated, a further loan asked of the deluded investors, for the most part poor people, would be a cruel wrong, because only serving to postpone impending disaster and raise hopes that cannot be realized. All the work done for a twelvemonth, and even longer, has consisted of the dredging of soft material by contractors paid by the cubic yard; men not in anywise identified with the project, and having no interest in either its success or failure. Meantime the projectors have been considering the really formidable problems on the solution of which depends the final accomplishment of the work. Foremost of these is the control of the torrents that at various periods pour down the sides of the mountains, and which, if unchecked, make all hope of maintaining a canal vain, and still another is the obstacle interposed by a mountain which has been found to be moving slowly into the very path of the canal. Add to these the deadliness of the climate and the important difference between the mean level of the two oceans which the canal is designed to connect, and it is not surprising that the engineers in charge of the enterprise, skilled engineers as they are, have not been able to discover a practical means of accomplishing their purpose. Now, when it is too late, the French investors will realize that the unfavorable reports from the United States which have followed the work from its very inception have not been animated by ungenerous motives. At the International Canal Congress, which met in Paris, May 15, 1879, Admiral Ammen and Captain Selfridge, of our navy, and the accredited representatives of the United States, declared that the route by way of Panama was impracticable. Both these officers are identified with a series of careful surveys made across various parts of the isthmus, including Panama, and their opinion was supported by that of many other engineers who preceded them on the isthmus. But the French were inexorable. Lieut. Lucien N. B. Wyse, of the French republican navy, had made a reconnaissance across the isthmus, and the French engineers, led by De Lesseps, who, it may be said without prejudice to his fame, has won more victories in the line of diplomacy than in that of engineering, showed a hasty willingness to accept Wyse's conclusions, though they were opposed by the experience of older and more experienced men than he.

Bad management was apparent at the very start of the enterprise, and if the two officers of the company who recently came hither from Panama on their way homeward are to be believed, this bad management has continued up to the present. Large quantities of material, as unnecessary as it was costly, have been constantly sent out, only to rot or rust in the swamps or on the sides of the hills. As many as fourteen locomotives, too heavy for use on the temporary lines constructed along the soft dump mounds, are at the present time rusting and corroding in the various sections, and apparatus and tools in vast quantities, whose design or weight precludes its use, is strewn along the highways or remains unpacked upon the shores of the port.

Reports say that both the French and United States governments will be asked in turn to take up and carry out the project of a canal at Panama, but it is not likely that either will do so. No doubt strenuous efforts will be made to reorganize the present company, if these negotiations fail, and to secure more capital. There is little probability, however, that much more money will be expended on this unfortunate scheme, where already several thousand human lives have been sacrificed and over $275,000,000 expended, and all for nothing!

HOW WAS THE UNEBI'KAN LOST?

The disappearance of the new Japanese cruiser Unebi'Kan, while on a voyage from Europe to Japan, is exciting much interest on the other side of the ocean, especially among naval officers and ship builders. A model ship she was, being both fleet of foot, strong in battery and buoyancy. She was built in France by a famous designer, and officered and manned by Frenchmen, with a dozen Japanese to make up the complement, two of whom were experienced officers, drilled in European naval schools. She arrived safely at Singapore late last November, and departed thence for Yokohama on the 3d of the following month. What course she took from Singapore can only be conjectured; and the English, who generally follow one course with steamers—the direct one which leaves the Paracels Islands either on the starboard hand or to port—incline to the opinion that her commander, through error of judgment, followed the course *via* the Palawan passage, and either foundered in the monsoon, which reports say was, at the time, more than usually fierce, or came to grief in the passage itself, which contains no end of reefs.

Against the former we have the fact that the Frenchman brought his ship safely through a terrific gale some days out from Port Said, and that the Unebi-K'an proved herself a really admirable seaboat. From all accounts, her powerful engines forced her through the seas with rare precision, and she would seem to have been as staunch and stiff as a church steeple withal. There is no reason why, knowing the power of his engines, her commander should not have taken the direct but far more boisterous route east or west of the Paracels; and for the same reason, if more familiar with the eastern or Palawan passage, he would seem to have been justified in taking that, even though he heard at Singapore, as no doubt he did, that the southeast monsoon was blowing with unwonted violence.

To the minds of many who have sailed with big guns, the fact, as reported, that the cruiser "carried two 35 ton guns well up above her water line" will have an important significance. Had one of these broken adrift while the ship was laboring in the heavy seas, it is not likely that any amount of good seamanship on the part of her commander would, under the circumstance of their unshipshape setting, have sufficed to save her. The rush of such a gun to one side at a critical moment might, with the leverage exerted by its mate in the same direction, be enough to capsize the ship in the same manner as the British ironclad Captain was capsized; though the latter was masted, and the Unebi'Kan was not. The course taken and the track made by the Frenchman from Cherbourg to Singapore shows him to have been a close and careful navigator, and, though not of that class of old sea dog having a face like a lion and the paws of a bear, evidently possessed good judgment and a sailor's instinct. The stability of the modern cruiser, especially this type, which is much shorter in the beam than the big war ship, and is good for nineteen knots an hour in a smooth sea, is of unusual importance at present, because it is thought to be the most efficient yet constructed. But if the beam is insufficient for the size of the present battery, or the center of gravity is too high up for weathering critical moments of wind and sea, the information cannot come too soon; and besides the humane desire to learn the fate of the officers and crew of the ill-fated Unebi'Kan, the naval world will await with impatience the solution of the mystery hanging over the disappearance of the Unebi'Kan.

INFECTION FROM DAIRY PRODUCTS.

The subject of purity and healthfulness of milk and its products has received much attention from medical and sanitary authorities during the past year, and some very remarkable results of investigations are now being made public. It has been found that milk may be the vehicle of very serious contagion, and that the diseased condition of the cow may so affect its milk as to make it the disseminator of acute disease. Coincident with this work, a contemporary has collected from all over this country and Canada the opinions of professional authorities on the subject of the milk of distillery swill-fed cows. The opinions are generally adverse. The subject is of special interest at the present period. Legislation adverse to artificial butter has been carried and is now in force. From the investigations we allude to, it appears that there is every chance that artificial butter or oleomargarine is the safer product of the two.

A lecture on the etiology of scarlet fever was recently delivered by Dr. E. Klein, F.C.S., before the Royal Institution in London. The principal theme of the paper was the relation of scarlet fever to milk supply. The possibility of the dissemination, and even origin, of the disease from this source was considered at length. Recorded cases are quoted to prove its possibility. The lecturer treats it as a certainty that milk has thus caused the spread of scarlet fever.

Experiments by V. Galthier, a French scientist, have been published. These were directed to tubercular sickness. Dairy produce from cows affected with tubercular disease was the subject of the investigations. Prof. Galthier found that such articles of diet could communicate phthisis or consumption to poultry and swine, and could become thus directly or indirectly a serious menace to man.

Within the last few years a number of outbreaks of disease have been traced with great certainty to dairies as the center of contagion. So well proved have these cases seemed, that they have originated special popular names for the sicknesses thus occasioned. Thus milk typhoid, milk scarlatina, and milk diphtheria have come to be recognized. In a number of accurately recorded cases, an outbreak of some specific disease has been noted. The general history in all was identical. The spread was limited to a certain number of families. The medical officers found that all the families thus affected were supplied with milk from the same dealer. Then, on examining the stables or dairy whence the milk came, the source of contagion was manifest. A case of scarlet fever would be found in the family or among the employes, or some of the residents possibly had diphtheria. In a number of instances such conditions were established. At the present time the English health authorities consider these cases proved. They form the basis for a somewhat disquieting suspicion affecting our milk supply. The means of guarding against the trouble in its source are not simple, owing to the extended range of

milk producers. The farmers are scattered all over the country, and an inspection of all the dairies hardly seems within the bounds of possibility.

Milk is so easily affected by aerial contamination that the above state of affairs seems only too probable on its face. It is known to all dairy workers that scrupulous cleanliness and good air are essential to the preservation of milk. A decaying substance in a cellar will affect all the milk and butter that may be present, imparting to it or causing in it a disagreeable taste.

But there is a more alarming aspect of the question. The result of some of the more recent observations is that cows may themselves become infected with a sickness resembling scarlet fever, and that such cows may, by their milk, cause the true scarlet fever to be developed in human beings.

This conclusion has been led to by an examination of data in recorded cases. In some instances where the origin of the sickness was traced to milk, and where also a scarlet fever case had existed in some person connected with the dairy, too long a period elapsed before the breaking out of the epidemic to allow it to be attributed to direct conveyance by the milk. Another class of cases is cited in which a human origin, proximate or ultimate, could in no way be traced. In one such instance an outbreak of scarlet fever was associated with a certain dairy. No human being could in any way be fixed upon as the originator. Even the sanitary conditions were examined, with negative results. The disease was finally attributed to certain cows. Examination of them showed the presence of disease, whose symptoms included sores upon the body, ulcerations, and a visceral complaint resembling that occurring in scarlet fever in the human being. The outbreak had, from other data, been limited to these cows as a source. Their disease so similar to the human scarlet fever made it almost a certainty that they were the origin of the trouble.

The examination by bacterial analysis was entered into, and confirmed these suspicions. The same micrococcus was found in the blood of scarlet fever patients and in the affected cows. The action of the human microbe on animals was identical with that of the vaccine one. This investigation, a full outline of which it is needless to give, clinched the proof. Succeeding occurrences investigated in the same general way gave identical results.

It may be considered as clearly proved that milk can be a serious source of danger to health or life. The remedy is a simple one. By heat the micrococci are destroyed. If the milk is heated to 185° F., it will be rendered safe. Any infectious microbes present will be killed. But while this disposes of the milk, it does not touch the disposal of milk products. Butter, cream and cheese are all uncooked. Butter represents raw fat, or uncooked oleaginous matter. It cannot be heated to a high degree without injury. One of the methods of freeing it from casein was to melt it, but the process was found to cause deterioration. Butter must be uncooked.

In this is found a strong plea in favor of oleomargarine. The argument is of such force that it would seem to entitle artificial butter to a little more consideration than legislators have awarded it. It is well known that the manufactured article keeps better than the natural one. In cruises to the West Indies and tropics, it is found that real butter tends to turn rancid. The process of manufacture, owing to the heat employed, cannot fail to leave oleomargarine free from bacteria. These recent observations afford other pleas in its favor.

The recent papers on the subject of the milk alkaloid tyrotoxicon show one cause for milk infection. It now seems certain that, as this alkaloid or ptomaine, tyrotoxicon by name, has come to be recognized as a cause of illness, it will be supplemented by such bacteria as those alluded to. Certain inexplicable cases of milk or cheese poisoning, when analysis shows no tyrotoxicon, may thus be accounted for. Cream cannot well be heated, and may be the vehicle for contamination. Ice cream thus may produce illness. It has been definitely proved that cold has so little effect on bacteria that the freezing of ice cream is but a slight safeguard, if any.

Several cases of ice cream poisoning have been noticed. As it is necessarily made from a raw product, and as freezing is so well endured by bacteria, it is possible that bacterial infection, quite unsuspected, was the cause.

The Safety of Modern Oil Lamps.

BY S. B. NEWBURY AND W. P. CUTTER.

By the law of this State, no oil or burning fluid which evolves an inflammable vapor at a temperature lower than 100° Fah. is allowed to be sold, transported, or stored. In order to determine whether a given sample of oil complies with this requirement, a small portion is gradually warmed in a partially closed vessel, and tested from time to time by bringing a small flame near the surface. The appearance of a bluish flame upon the oil indicates that the "flashing point" has been reached. The standard fixed by law, namely, 100° Fah., is based upon the temperature which the oil is supposed to reach when burned in an ordinary lamp, and no danger of explosion is to be apprehended in case the oil in the reservoir of the lamp remains at a temperature considerably below that at which it may give off an inflammable vapor.

Professor C. F. Chandler, of Columbia College, made in 1872 a series of experiments on the temperature which the oil may attain in lamps of different patterns. The results of this very careful and exhaustive research have been constantly quoted, and have for many years formed a reliable basis for discussions concerning the safety of illuminating oils. In the case of twenty-three lamps, Professor Chandler found the average temperature attained to be 83° Fah., the air in the room standing meanwhile at 74° Fah. The highest temperature reached was 100°, which seems to have been an exceptional case, as of the remaining twenty-two lamps, no one gave a temperature of over 91° Fah.

Within a very few years great changes have taken place in the construction and power of the burners used on household lamps, resulting in a very great improvement in the brilliancy and steadiness of the light. These modern burners give out also a great deal of heat, as every one using them must have noticed. It seemed to the writers desirable to determine to what degree the oil in these modern lamps becomes heated, and thus to ascertain whether the present legal standard is sufficiently high to afford protection from danger of explosion. For this purpose two of the most powerful modern burners were chosen, the "Rochester central draft" and the "Electric Argand," and were compared as to heating power with a "Duplex" burner having two wicks, each one and one-half inches wide, and an ordinary single burner with a wick one inch wide. Tests were made in glass and metal lamps, except in the case of the Rochester burner, which requires a lamp of special form made only in metal. In all these experiments the temperature of the oil was ascertained by means of a small thermometer fixed by a rubber stopper in the orifice by which the lamp is filled, and so placed that the bulb dipped about an inch below the surface of the oil. The temperatures reached, in Fahrenheit degrees, after two and a half hours' burning, are as follows, the air in the room standing meanwhile at 74°:

Burner.	Glass lamp.	Metal lamp.	Metal lamp with shade.
Rochester.....	—	100	104
Electric Argand.. .	97	98	110
Duplex..	95	96	110
Single.....	86	88	94

The above table shows that the oil in metal lamps becomes more readily heated than in those of glass, as Dr. Chandler has already pointed out. The very high figures of the third column show how greatly the heating of the reservoir is increased by the use of a white shade. The lower result given by the Rochester burner is probably owing to the constant current of air which in this form of lamp passes up through the central tube of the reservoir, and thus to some extent keeps the oil from becoming heated. The single burner may serve as a type of those generally used some years ago, and by comparison with this the greatly increased heat given out by the more powerful burners is plainly shown.

If there is any relation between the temperature reached by the oil in the lamp and the danger of explosion, which we can scarcely doubt, these figures certainly show that an oil which would be safe in an old fashioned lamp might be dangerous in a modern one; and further that the legal standard of 100° is actually lower than the usual temperature of the oil in the lamps beside which we habitually write our letters, or about which our families gather in the evening.

It is of course impossible to state what degree of danger may exist under such conditions, but there can be little doubt that an oil heated in a lamp beyond the flashing point is dangerous, whether that flashing point be high or low. Absolute safety can only be obtained by the use of thoroughly reliable oils of a higher standard than that required by law. Fifteen years ago, long before the introduction of these modern burners of high heating power, Dr. Chandler urged the adoption of a much higher legal standard than the present one, and stated that the requirement of a flashing point not lower than 120° would add but a few cents per gallon to the cost of the oil. Now that the necessity of better oils has become urgent, and in view of the great progress that has been made in the process of petroleum refining, the adoption of a more strict legal requirement would certainly cause no hardship to manufacturers.

The results of the tests given above are by no means a reproach to the new forms of burners which have been lately introduced, for the excellence of the light which they give will always greatly outweigh the trifling increased cost of better oil. Dealers who supply these lamps should, however, take especial pains to furnish oil of suitable kind, and should insist that no inferior article be used. Certain well known brands of oil show a flashing point far above the legal requirement, and are thoroughly safe to use in any modern lamp. The manufacturers of these oils should welcome a standard which would shut out all inferior products from the market.

We are at present engaged in an extensive series of tests of various commercial oils of different flashing points, with the object of determining the comparative illuminating power of each when used in the best modern lamps. We have little doubt these experiments, when completed, will show that the use of oils of higher grade is in the interest of economy as well as safety.

Laboratory of Cornell University, June 10, 1887.

Recent Ballooning.

At Quincy, Ill., July 4, Mr. Baldwin, the aeronaut, made a balloon ascension, and when at a height of 5,000 feet, leaped from the basket with a parachute and descended safely to the ground. Time, 3m. 20s. It was an extraordinary performance.

At Portland, Me., says the *N. Y. World*, on July 4, Prof. Charles H. Grimley, a well-known aeronaut, and one man made the start from Lincoln Park, in the center of the city, at 5 o'clock in the afternoon. The wind was from the south and it was expected that the balloon would pass over a small part of Casco Bay and descend on the mainland of Falmouth, five miles further on.

The balloon rose about two thousand feet and then struck a westerly current, which carried it rapidly toward the open ocean. At the rate it was traveling it would take less than half an hour to cross the bay and be beyond the outer islands, where the sea was running high. Prof. Grimley at once saw the danger, and although he had passed the city limits he determined to descend into the bay. Prof. Grimley said that, no matter at what risk, the balloon must come down; and, obeying his touch on the valve line, the balloon, at that time rapidly sweeping along at a height of over two thousand feet, was made to take a downward course, settling with great speed, while passing over one of the small islands.

Opposite Windward Cove the professor let go the drag rope, and on nearing Clapboard Island he began to hope that the wayward balloon might be stopped by catching in the tops of the tall pine trees. The long cable dragged through the trees, sawing off branches and mowing a path through the twigs and boughs, but not stopping the balloon. A number of men on the island ran in the direction the balloon was drifting. The drag rope whipped about the trunk of a tree and held fast for a moment, while the men secured it to a large rock. Then the wind rose again, and the balloon bounded upward and strained with wonderful power on the rope, which had been passed around the bowlder and securely fastened. For a second the rope resisted the pressure, and then it parted as though it had been but a cord.

The released balloon went up, stood still for a little space, and, feeling the influence of the strong wind, went forward and downward into the ocean, burying the basket completely beneath the waves, and submerging the professor and his companion. The balloon slashed through the water at a terrific rate, and the strain was tremendous. Only a thread was between the two wet and sorely pounded men and death. The balloon was soaked and in danger of bursting. If this had occurred, the basket would have at once sunk and the outflow of gas would have suffocated the voyagers.

Fortunately, the varying course of the balloon was in the direction of a yacht. The men on board managed to secure the drag rope, and the aeronauts, clearing themselves from the ropes, sprang into the water. Their removal from the car caused the balloon to rise again, and in a moment it was sailing out to sea. The voyagers were picked up by the yachtsmen. The balloon was lost.

OLEAN, N. Y., July 5.—Aeronaut Clarage, who fell from his balloon yesterday afternoon, remained unconscious until 1 o'clock to-day, when he died.

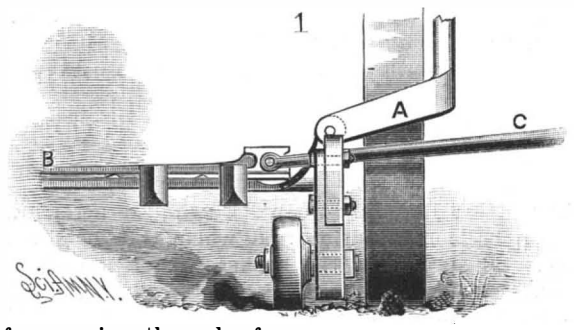
LONDON, July 5.—A Havre dispatch says that the well-known aeronaut L'Hoste made an ascension on Sunday afternoon from Dunkirk, France, steering for England. Shortly after midnight, while off the mouth of the Thames, the balloon began to descend, and though ballast was promptly thrown over, he fell into the sea. He was picked up by an English steamer.

Shark Fishing at Nantucket.

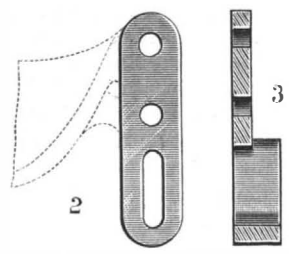
Mr. Albert A. Gardner, of Nantucket, Mass., writing on July 13, 1886, to Prof. Baird, stated that the primary object of shark fishing about Nantucket was sport, the boatmen taking out parties for this purpose. The profit arising from catching the sharks is of a secondary nature. The bait used in fishing is fresh fish, if possible; otherwise, a piece of salt pork is used. The only portions of the shark having a value are the liver, for the oil it contains, and the jaw, which after being cleaned is worth from $1 to $7, according to size and quality. Many of the sharks taken are worthless, except for the oil contained in the liver, and are simply destroyed.

A MOWING MACHINE ATTACHMENT.

A simple attachment, which permits a higher adjustment of the cutter bar of mowing machines from the ground, has been patented by Mr. Alexander White, of Kerbyville, Josephine County, Oregon, and is shown in the illustration. It consists of an independent arm or downward extension piece, adapted to be applied to the arm piece on the front end of the inner shoe—that is, the shoe at the inner or heel end of the sickle bar—



for carrying the axle of the leading wheel or roller at a greater height from the ground than is usually necessary, as may be desirable when running the machine over rough or stony ground, or land in which the main wheels sink. In Fig. 1, A represents the swinging bar by which the cutting mechanism is suspended from the main axle of the machine, B the sickle and finger bars, and C the rod by which the cutter is reciprocated, Figs. 2 and 3 showing different views of the attachment, which has an upper diminished portion and a thicker lower portion, with a downwardly running oblong slot through it. The attachment is made fast to the outer side of the arm of the shoe by flat headed bolts, while the thicker portion of the attachment projects under the arm of the shoe and forms a shoulder or bearing for the shoe to rest in, this thicker portion also forming a broad or extended support for the axle of the leading wheel, said axle being adjusted within the slot shown in Fig. 2. When not required, this attachment may readily be detached.

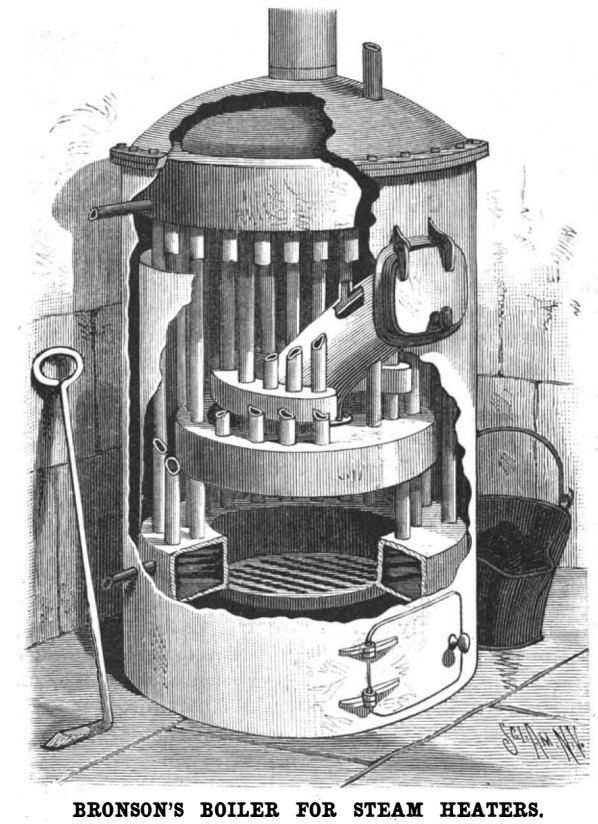


WHITE'S ATTACHMENT FOR MOWING MACHINES.

AN IMPROVED BOILER FOR STEAM HEATERS.

A novel construction of boiler for steam heating apparatus, by which all danger of burning out or overheating the feed chute is avoided, is shown in the accompanying illustration, and forms the subject of a patent recently issued to Mr. William C. Bronson, of Saratoga Springs, N. Y.

The arrangement of the three circular water chambers around and above the grate, and the manner in which they are connected and a good circulation



BRONSON'S BOILER FOR STEAM HEATERS.

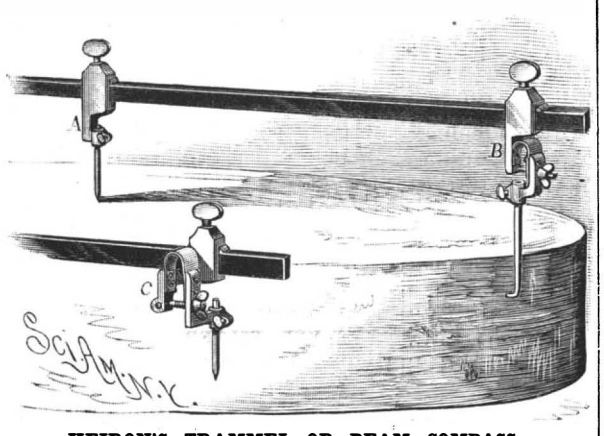
effected, by the various upright pipes leading to the dome of the heater, is well shown in the picture. The feed chute, which has an outer opening just below the dome, leads thence inwardly and downwardly over the grate, the fuel ordinarily partly filling it, but its walls are surrounded by a water jacket, the interior of which is also in communication with the other water spaces and with the dome. It is intended that this boiler, when provided with automatic regulating attachments, will run perfectly well for twenty-four hours without attention.

Conversion of Heat into Electricity.

Messrs. Hurghausen & Nerust have devised a most curious experiment from the scientific point of view. A thin metallic leaf is placed in a magnetic field. If its extremities are maintained at uneven temperatures, they have discovered that a difference of potential is manifested by these portions—extremely slight, it is true, but quite appreciable. Moreover, the direction of the current varies with the lines of force of the magnetic field. They used a piece of bismuth, 5 centimeters (2 in.) square and 2 millimeters (1-12 in.) thick, which they placed in a field of 5,000 units. The difference of temperature was secured by placing two pieces of mica in contact with the ends of the piece, one of which was immersed in cold water and the other heated by an alcohol lamp. Under these conditions they have obtained a difference of potential of 0·00125 volt.—*L'Elettricita.*

AN IMPROVED ADJUSTABLE TRAMMEL.

The use of a trammel or beam compass, such as the one herewith shown, for accurate gauge measurements or for describing circles is much facilitated if the device possesses means of a ready and exact adjustment, and these are points which form the principal feature of a patent recently issued to Mr. Alban Heiron, of San Leandro, Cal., our illustration showing the device as adjusted for use in connection with a circular body, as a grindstone. The two slides are mounted upon the beam with spring blocks and set screws, slide A carrying a downwardly extending arm with a split socket, which may be provided with a point, as shown in the picture, or with a pencil or bent caliper point. The downwardly extending arm of slide B carries one leg of a U-spring, a socket being secured to the other leg of the spring, the arm of the slide being made to extend from one side, if desired, as shown in the figure marked C, in which case the point socket may be



HEIRON'S TRAMMEL OR BEAM COMPASS.

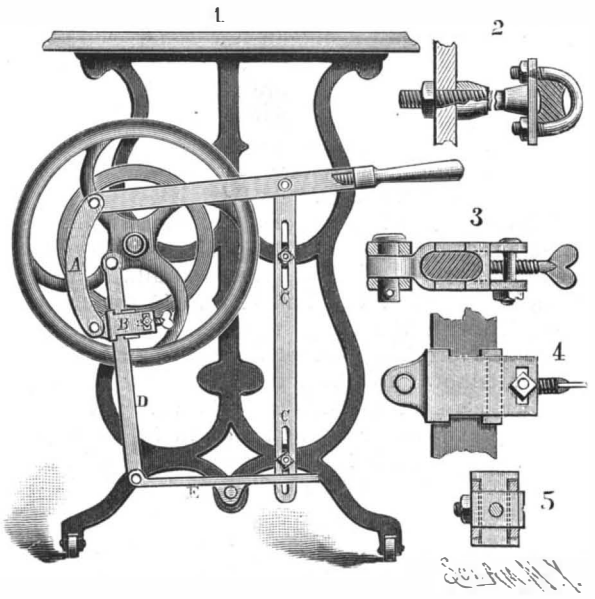
brought beneath the beam, and the connection shortened up between the beam and the point supported thereon, while still allowing room for the spring connection. A screw is pivotally connected to the downwardly extending arm, as shown in slide C, passing through an aperture in the oppositely connected spring arm, and having a winged nut, by turning which, after an approximate adjustment has been obtained by adjusting the slide upon the beam, an exact adjustment of the points may be quickly and readily secured.

Emission of Ammonia by Vegetable Mould.

The authors' results apply essentially to the cultivated clay soils of the neighborhood of Paris. This soil emits spontaneously ammonia by reason of the slow decomposition of the amidic and ammoniacal compounds which it contains. This decomposition is effected at once under the influence of purely chemical actions due to water and earthy carbonates, and doubtless also under the influences of purely physiological actions due to fermentation, to microbia, and to vegetation properly speaking.--*MM. Berthelot and Andre.*

DEVICE FOR OPERATING SEWING MACHINES BY HAND.

The invention herewith illustrated shows a hand attachment for operating sewing machines, which has been patented by Mrs. Lois Waite McClung, of Pueblo, Col., and in which the connecting devices are so formed that the improvement may be readily applied to machines of almost any size. In Fig. 1, D and E represent the ordinary form of pitman and foot treadle, as connected with the driving and balance wheels; B shows a novel form of clamp attached to the pitman, the details of this clamp being fully given in Figs. 3, 4, and 5. A is a link pivotally attached at one end to the clamp upon the pitman, and its other end to a lever which has an operating handle, and is pivotally mounted upon an upright bar connected to the machine frame by clamping attachments, C C, shown in detail in Fig. 2. It will be readily understood that the pitman clamp is so made as to take in and firmly clamp different sizes of pitman, having U-shaped arms, in which works a follower that is moved forward and forced against the pitman by a thumbscrew. The frame clamping attachment holding the upright bar, upon which the operating lever is pivoted, consists of a T-shaped bolt, its outer end threaded to be engaged by nuts to fix the upright bar, through the slots therein, at the desired height, and its head flanged and double-apertured to receive the threaded arms of a U-bolt, by which a firm clamp is made upon the frame of the machine. The handle of the operating lever can be readily removed when it is not desired to operate the



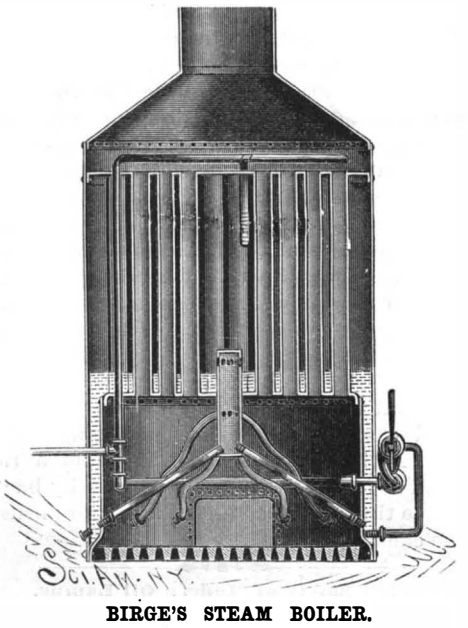
McCLUNG'S DEVICE FOR OPERATING SEWING MACHINES.

machine in this way, and the treadle only is to be used.

For further information address the patentee, or Mr. J. S. McClung, Pueblo, Col.

A QUICK STEAM MAKING BOILER FOR FIRE ENGINES.

It is obvious that the boiler herewith illustrated possesses great heating power for the comparatively small quantity of water with which it is operated. The fire box is surrounded by a water space, from near the lower portion of which, pipes, bent in somewhat serpentine shape to expose more surface, extend upward through the open space of the fire box to a central large tube fitted in the lower tube plate, and having several discharge openings above the tube plate. In operation this causes a constant flow of water from the bottom of the water leg, through the pipes in the fire box, to the main water space above the tube plate. The feed water enters through the pipe shown at the left in the picture, thence passes upward at one side and through a pipe coiled above the upper tube plate, to be discharged from a rose in the main water space. To the lower end of the feed water pipe is connected a pipe that is carried around the inside of the fire box, there communicating with a pump, shown at the right in the picture. When this pump is operated, which generally need be only for quickly circulating the cold water when the fire is started, water is taken thereby from the lowest part of the water leg, passed half way around the inside of the fire box, and thence through the feed water pipe and its coil above the tube plate to the place of discharge in the boiler.



BIRGE'S STEAM BOILER.

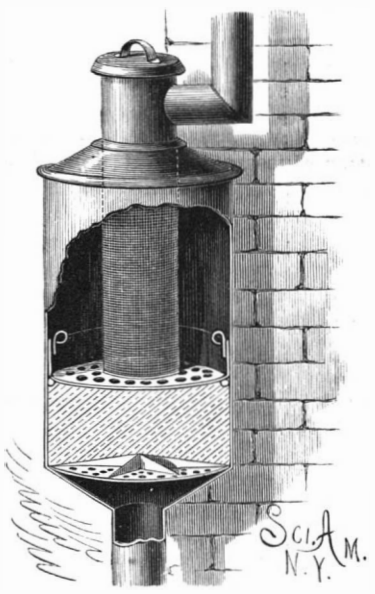
This boiler, which has been recently patented by Mr. Elias B. Birge, of St. Paul, Minn., is especially designed for steam fire engines, although it may be likewise used for locomotives and all classes of portable engines. In a steel boiler which the inventor has had made, it is stated that steam was raised to a pressure of 25 pounds from cold water, and without the use of the auxiliary pump, in 4 minutes and 22 seconds, there being no foaming or priming in testing and working, and there being no leaks from expansion and contraction.

AN IMPROVED FOLDING IRONING TABLE.

An ironing table which stands firm in position, which can be set up with one locking motion, and can be moved from place to place without collapsing, is represented in the accompanying illustration, the small figure giving a side view of the table as it appears when folded. On the under side of the broad end of the table is a block, to which is hinged a diagonal bracing rod, whose lower end is made of a bifurcated casting form-

BURCAW'S IRONING TABLE.

ing feet, a bracing strip being pivotally connected to its upper face, which strip is held in supporting position upon the under side of the table or leaf by a rod, pin, and stop block. The main legs of the table are formed of a casting having upon its upper end forwardly extending lugs connected to brackets, so that when the legs are extended the lugs abut against the rear side of the block to which the diagonal bracing rod is hinged. When the table is open for use the several parts assume the position shown, all the movable parts abutting



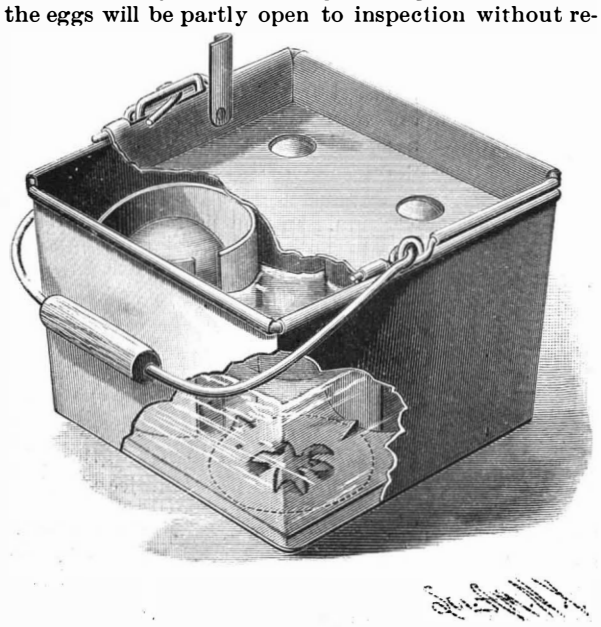
NESBET'S FILTER.

against some fixed stop, so there will be little or no side play, and the table will be very steady.

For further particulars address the patentee, Mr. Franklin P. Burcaw, box 226, Hazleton, Pa.

AN IMPROVED EGG CARRIER.

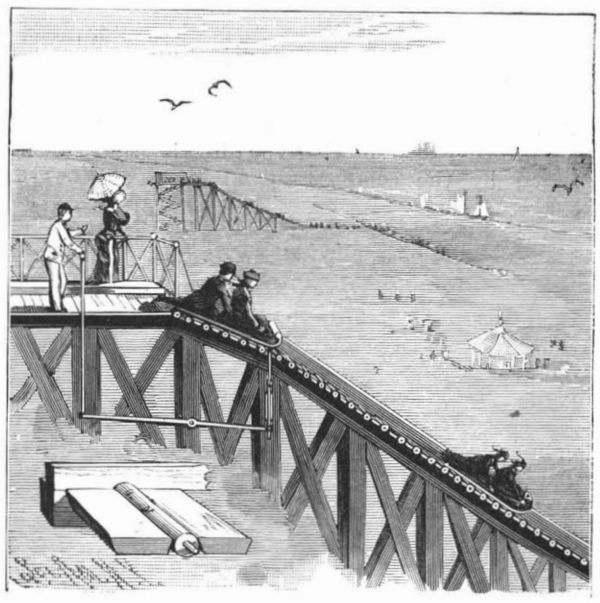
The invention herewith illustrated, recently patented by Mr. Harry E. Aylsworth, of Ashland, Kansas, is designed to provide a carrier in which eggs of various sizes may be held in spring supports, in which the eggs will be partly open to inspection without removing the cover, and may be refrigerated in transit and during storage. The case consists of a slightly flared rectangular box of tin or other sheet metal, a wire around its upper edge so bent as to form bail loops. The cover is inset, its upwardly turned edges also inclosing a wire adapted to engage with the bail loops on the case. The cover and bottom of the case have apertures opposite each other, in the line of the positions occupied by the eggs, permitting inspection, and through which cool water may be poured to flow downward over the eggs. Plates adapted to fit within the case have apertures corresponding with those in the cover and bottom, and from these apertures extend radial slits, forming a series of tongues, bent alternately in opposite directions to form springs or cushions for the eggs, these plates resting upon the bottom and between the tiers of eggs. The egg-holding cells are formed of sheets of metal, bent to accommodate themselves to the size of the eggs, on which they exert but a slight pressure, these cells being easily attachable to the bottom plate or that placed on any succeeding tier of eggs. These carriers, when not in use, may be packed in small space for storage or shipment.



AYLSWORTH'S EGG CARRIER.

A ROLLER TOBOGGAN SLIDE.

A novel construction of toboggan slide, especially adapted for summer use at seaside and other popular resorts, is shown in the accompanying illustration, and forms the subject of a patent recently issued to Mr. George C. Peeling, of Lock Haven, Pa. Upon a suitable framework support are arranged side bars, which carry alternate slats and rollers, the side bars forming, in connection with the frame, an inclined way, in which the toboggans move downward. The manner in which the slats are made to alternate in the flooring of the slide is shown in the small figure; but where the inclined section of the slide joins the horizontal section at the foot of the incline, the rollers are placed more closely together, to prevent the toboggan from striking against the slats at this point. The bearings of the rollers are preferably of metal, and lubricating holes are provided for their journals. At a point near the top of the incline there is a sliding stop, connected to a lever pivoted to the framework, and by an operating cord leading therefrom to the top of the slide the attendant is able to readily release the toboggan at will, it having previously been held back by the stop until ready to start.



PEELING'S TOBOGGAN SLIDE.

AN IMPROVED FILTER.

The invention herewith illustrated is designed more especially to furnish a filter for rain water, by which the water delivered from the roof is strained and filtered before entering the cistern. The main features of its construction will be readily understood from the illustration, the water first passing through an inner perforated sheet metal or wire cloth cylinder, to prevent the passage of coarse particles to the filtering material, which rests upon a ridged and perforated bottom. Upon the top of the filtering material is a perforated pan, which rests upon a shoulder on the inner walls of the outer inclosing cylinder, and has upwardly projecting sides, with handles, by which the pan may be easily removed. This strainer and filter presents an extended straining surface, and is so arranged that when any of the parts are fouled, they can be readily cleansed.

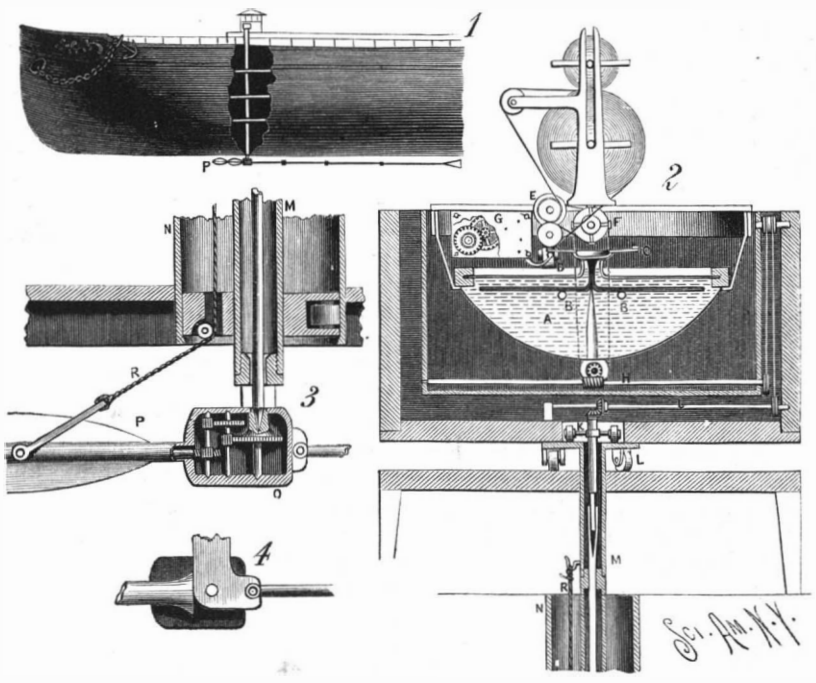
The above invention has been patented by Mr. William T. Nesbet, and for further particulars address Mr. D. Postlewait, Schell City, Missouri.

A RECORDING COMPASS AND MARINE INDICATOR.

An invention to provide means for automatically indicating the speed of a vessel, the leeway it makes, and the direction of sailing, and keep a complete record thereof, is illustrated in the accompanying engraving, and forms the subject of a patent recently issued to Mr. Richard W. F. Abbe, of No. 70 East Seventh Street, New York City. Fig. 1 shows the device applied to a vessel. Fig. 2 is a sectional view of the indicator, which is designed to occupy a space only about 20 inches square, and to be placed in the cabin or navigation room of the vessel. Figs. 3 and 4 show the driving mechanism.

In constructing the indicator, a cup-shaped vessel, A, is suspended upon hangers, by its rim, from a ring pivoted at right angles to such supports, within a box, the latter being also hung upon pivots placed at diametrically opposite points within an outer box. The cup-shaped vessel has a top plate with upwardly projecting neck, and is filled with glycerine or a like liquid almost to the top of the neck. A compass card, carrying on its lower surface a U-shaped magnet, B B, is pivotally mounted within the glycerine, and from the center of the card a stem projects upward through the neck of the top plate, this stem carrying a circular plate, from which a series of type levers, C, project radially. There are as many type levers as there are points of the compass, and they are marked with letters corresponding with those on the compass card above which they are located. A clockwork, G, is arranged to cause these type levers to print upon a strip of paper unwound from a coil above, the strip passing through continuously, with a speed corresponding to the speed of the vessel, and being rewound in another coil, thus furnishing a printed record, the clockwork being set to print successive impressions at regular intervals, say every minute, every two minutes, or every five minutes, as desired. The compass card, turning freely on its pivot, as the direction of the vessel changes, will bring the different type levers in position to be operated by the hammer of the clock mechanism—the same character printed successively for a number of times showing that the vessel's course has not been changed.

The speed of the vessel is marked by the rate at which the strip of paper is passed through the recording apparatus. This is effected by a vertical shaft extending from below the keel up to the indicator, motion being given to this shaft by a screw, P, suspended in horizontal position just below and in line with the keel, and with which is connected, as shown in Fig. 4, a jointed vane rod about thirty feet long, the screw revolving with greater or less rapidity as the speed of the vessel increases or diminishes. This vertical shaft is carried in an inner tube, M, with necks in which the shaft may freely revolve, and by means of beveled gears, the shafts, J and H, and the cone pulleys, E and F, causes the paper strip to pass through the recording apparatus at a speed corresponding with that at which the screw revolves. In an outer tube, N, surrounding the shaft-carrying tube, M, passes down a rope or chain, R, made fast to a hook at its upper end, and its lower end carrying a pivoted hanger to which is attached the propeller frame. When the indicator is not to be used, or when the vessel stops, the box containing the apparatus is removed from the top of the tube, the chain, R, is disengaged from its hook, to permit the propeller to swing down, the vane rod also swinging down as the vessel stops, and all the



ABBE'S RECORDING COMPASS AND MARINE INDICATOR.

parts on the lower end of the tube, M, carrying the operating shaft, can be drawn up through the outer tube, N.

When a vessel is making leeway, this fact is shown by the turning of the box carrying the indicator on its wheels, L. The effect of a current carrying a vessel out of its course will be to swing the vane rod proportionately across the line of the ship's keel, and this turns to a like extent the tube, M, whereby the box carrying the indicator is turned on its table.

As the impressions on the paper strip will be at a greater distance apart when the ship sails rapidly, the speed made at all parts of its course will thus be indicated by the printed record, the characters made by each printing also showing the direction sailed, as indicated by the compass, at all times during the voyage.

OUR NEW NAVY.

[*See illustration on first page.*]

A visitor to the Atlanta at the Brooklyn Navy Yard is immediately struck by the appearance of the ship, even before going on board, she is so totally different in appearance from anything we have hitherto been accustomed to. We find nothing of the graceful sweeping lines, tall, raking masts, and maze of rigging so inseparably associated in our minds with former ships of war. Everything here is hard, severe, straight, nothing of the jaunty or graceful—a practical utility visible everywhere.

The broad open decks of the frigate of '61, with its rows of big black guns glistening in the sunlight, give place to a few of the modern high power, small bored naval rifles. Their breeches set low to the deck, and to the old artillerist have a most bewildering lot of wheels, cogs, tracks, and scientific inventions, all covered in by a heavy bullet-proof shield, looking much like a huge inverted coal scoop, from out which extends the gun barrel, long, slender, tapering.

The great perfection and finish to which these guns have been brought is better realized as soon as the breech of one is opened. The interior shines like burnished silver, and the grooves, threads, and rifling are as clean cut and perfect as the mechanism of a watch.

Not the least curious part of these rifles is the new system of firing. The old fashioned style of ramming a long priming wire into the vent hole to pierce the cartridge case before firing, which necesitated appreciable time and care, especially in battle, has given place to a new invention by which a curious piece of mechanism, a veritable breech loading firing lock, is screwed on to the breech closer, in which a bullet-loaded cartridge is fired into the main charge. The bullet from this discharge traverses a fine smooth bore cut through the main breech closer, piercing the main cartridge and instantly opening up a passage for the flame to follow and ignite the charge, as shown in the cut.

The marines of the Atlanta are armed with the Springfield rifle, while the crew have the Lee modified magazine gun, which can also be used as a single shot. These new arms require the men to carry much more ammunition than formerly, and the old fashioned cartridge boxes are replaced by broad belts carrrying 80 rounds, the whole supported by suspenders over the shoulders.

Our picture shows a squad of naval apprentices thus equipped as a landing party going through the skirmish drill of loading and firing.

Depth of the Charleston Earthquake.

In a communication to the American Academy of Sciences, Captain C. E. Dutton gives a calculation of the depth of the Charleston earthquake centrum, which puts it at the enormous distance of twelve miles below the earth's surface. The calculation by Robert Mallet of the depth at which the Neapolitan earthquake of 1857 originated was the first attempt to solve such a problem. Working on the assumption that the earth wave radiates in straight lines from the origin, and hence at different distances from the center of surface disturbance it has different angles of emergence, Mallet found that lines drawn parallel to these angles, if projected, would intersect each other at a mean depth of about five miles under the surface. From seismometric and other indications, the mean depth of the Yokohama earthquake of 1880 was calculated to have been about three and a quarter miles. While much greater depths of centrum have been assigned to some earthquakes, the accuracy of the calculations has been doubtful. Captain Dutton's new method of determining the depth of the focal cavity at Charleston gives, therefore, a most remarkable result. But his conclusion is in harmony with the observation of Mallet, that "earthquakes which have a very great area of sensible disturbance have also a very deep seismal focus."

THE polar position of the sun has not yet been exactly located. Its approximate polar point among the stars may be assigned, but is of no value in astronomical work, and is not mentioned in books.

Brass Workers' Disease.

Very little attention has been paid in this country to a certain class of disorders observed among brass workers. The best known class of symptoms is that constituting what is called "brass workers' ague." After being exposed to the fumes of the molten metals, copper and zinc, the workman feels a sensation of discomfort and weakness, followed by muscular pains and then by a distinct chill, with headache, and often cough. After fifteen or twenty minutes a profuse perspiration breaks out; then in a few hours the improvement begins. The patient recovers in one or two days, but is liable to a relapse. Brass founders' ague was first observed by Blaudet in 1845. It was described by Greenhow, of Birmingham, in 1858, and again by Hirt. Brass is an alloy of copper and zinc, the latter being in the proportion of 28 to 32 per cent. In the process of making, the zinc deflagrates and fills the air with the powdered oxide. Dr. Greenhow believed, therefore, that brass workers' ague was an acute poisoning with zinc. Hirt, however, thought it due to the mingled fumes of copper and zinc, because it is not observed among zinc smelters. Recently Mr. Edgar Hoglon (*Birmingham Medical Review*) reports a number of observations, and states his belief that brass workers' disease is due to chronic or acute copper poisoning. Almost all the patients who are copper or brass workers have a distinct green hue or band on the neck of the teeth between the crown and the gum. The edge of the gum is slightly blackened. The copious perspirations of brass workers are often stained green, and white-haired workmen often have a greenish tinge to their locks.

These signs point to an absorption of copper by the workmen, and favor the view that the "ague" is due, in large part at least, to this metal.

But these workmen also suffer from other symptoms of a chronic character, such as dyspepsia, metallic taste, colic, constipation and diarrhœa, nervousness, and pains of various kinds are felt. Deafness is not infrequent; cough and aphonia often occur. Paresis of the legs and symptoms like those of locomotor ataxia have been observed, and it seems probable that the copper can cause myelitis and neuritis, in the same way as does lead and other toxic agents.—*Medical Record.*

A Man Killed by a Swordfish.

In the last *Bulletin* of the U. S. Fish Commission received at this office, W. A. Wilcox, in a letter to Prof. Baird, relates a curious accident that befell Captain Langsford, as follows:

The schooner Venus is a small vessel of about 12 tons, owned and commanded by Franklin D. Langsford, of Lanesville, Mass., with a crew of three men, engaged in the general fisheries off the coast of Massachusetts. On Monday morning, August 9, 1886, Captain Langsford sailed from home in pursuit of swordfish. About 11 A. M., when 8 miles northeast from Halibut Point, in Ipswich Bay, a fish was seen. The captain, with one man, taking a dory, gave chase, and soon harpooned the fish, throwing over a buoy with a line attached to the harpoon, after which the fish was left and they returned to the vessel for dinner. About an hour later the captain, with one man, again took his dory and went out to secure the fish. Picking up the buoy, Captain Langsford took hold of the line, pulling his boat toward the swordfish, which was quite large and not badly wounded. The line was taut as the boat slowly neared the fish, which the captain intended to lance and thus kill it. When near the fish, but too far away to reach it with the lance, it quickly turned and rushed at and under the boat, thrusting its sword up through the bottom of the boat 23 inches. As the fish turned and rushed toward the boat the line was suddenly slacked, causing the captain to fall over on his back; and while he was in the act of rising, the sword came piercing through the boat and into his body. At this time another swordfish was in sight near by, and the captain, excited and anxious to secure both, raised himself up, not knowing that he was wounded. Seeing the sword, he seized it, exclaiming, "We've got *him*, any way!" He lay in the bottom of the dory, holding fast to the sword, until his vessel came alongside, while the fish, being under the boat, could not be reached. Soon the captain said, "I think I am hurt, and quite badly." When the vessel arrived he went on board, took a few steps, and fell, never rising again. The boat and fish were soon hoisted on board, when the sword was chopped off to free the boat, and the fish was killed on the deck of the vessel. The fish weighed 245 pounds after its head and tail were cut off and the viscera removed. When alive it weighed something over 300 pounds. Captain Langsford survived the injury about three days, dying on Thursday, August 12, of peritonitis. The certificate of Dr. Garland, written on the 16th of August, is appended, giving some further particulars, and the sword has been deposited in the U. S. National Museum.

CERTIFICATE OF DR. JOSEPH GARLAND.

This may certify that I was called to visit Franklin D. Langsford, of Lanesville, in Gloucester, on August 12, in consultation with Dr. Levi Saunders, who was in attendance upon the said Langsford, on account of a wound inflicted upon his body by a swordfish on 9th instant, said swordfish having driven its sword through the bottom of the fishing dory he was in to the length of 23 inches, penetrating the body of Langsford at the right of the os coccyx and entering about 7 inches, by the side of the rectum, into the pelvic cavity; that said Langsford was dying, and did die, in my presence, of peritonitis, having survived the injury about three days; that the sword accompanying this certificate is the veritable sword that occasioned the accident, and is to be sent to the National Museum at Washington.

Gloucester, Mass., October 14, 1886.

The Sun's Heat.

At a Royal Institution lecture, Prof. Sir William Thomson expounded the latest dynamical theories regarding the "probable origin, total amount, and possible duration of the sun's heat." During the short 3,000 years or more of which man possesses historic records there was, the learned physicist showed, no trace of variation in solar energy; and there was no distinct evidence of it even, though the earth as a whole, from being nearer the sun, received in January six and one-half per cent. more heat than in July.

But in the millions of years which geology carried us back, it might safely be said there must have been great changes. How had the solar fires been maintained during those ages? The scientific answer to this question was the theory of Helmholtz that the sun was a vast globe gradually cooling, but as it cooled shrinking, and that the shrinkage—which was the effect of gravity upon its mass—kept up its temperature. The total of the sun's heat was equal to that which would be required to keep up 476,000 millions of millions horse power, or about 78,000 horse power for every square meter—a little more than a square yard; and yet the modern dynamical theory of heat shows that the sun's mass would require only to fall in or contract thirty-five meters per annum to keep up that tremendous energy. At this rate the solar radius in 2,000 years' time would be about one hundredth per cent less than at present.

A time would come when the temperature would fall, and it was thus inconceivable that the sun would continue to emit heat sufficient to sustain existing life on the globe for more than 10,000,000 years. Applying the same principles retrospectively, they could not suppose that the sun had existed more than 20,000,000 years, no matter what might have been its origin—whether it came into existence from the clash of worlds pre-existing or of diffused nebulous matter. There was a great clinging by geologists and biologists to vastly longer periods, but the physicist, treating it as a dynamic question with calculable elements, could come to no other conclusion materially different from what he had stated.

Sir William Thomson declined to discuss any chemical source of heat, which, whatever its effect when primeval elements first came into contact, was absolutely insignificant compared with the effects of gravity after globes like the sun and the earth had been formed. In all these speculations they were in the end driven to the ultimate elements of matter, to the question—when they thought what became of all the sun's heat—what is the luminiferous ether that fills space, and to that most wonderful form of force upon which Faraday spent so much of the thought of his later years—gravity.

Annual Convention of the American Society of Civil Engineers.

On July 1 the American Society of Civil Engineers began its nineteenth annual convention. The hotel Kaaterskill, in the Catskill Mountains, was selected as the place for the meeting. The different sessions were devoted to topics of civil and railroad engineering, the meeting being a combination of professional work with amusement. A large number of ladies accompanied the members and added to the last-named feature. A number of papers were devoted to the subject of the "Maintenance and Inspection of Railway Structures." All mooted points of bridge construction and the expediency of legislation and methods of inspection were touched upon. In the light of some recent casualties, this is at the present time a subject of much interest. A description of the old De Witt Clinton locomotive, under the title of "A Triple Thermic Motor," and papers on "The Behavior of Mortars under Various Conditions" and "Experiments in the Testing of Cements" followed. The Poughkeepsie bridge was also discussed, and was the objective point of an excursion on July 5. Sewage disposal, the forms of wheels and rails, and the compressive strength of iron and steel were among the large list of subjects treated.

A banquet was given on Thursday, July 7, and on Friday, July 8, the meeting dispersed. Whether by its numbers or professional eminence of those attending it, it was a very memorable meeting. Between three and four hundred members were in attendance.

Correspondence.

Mineralogical Notes.

To the Editor of the Scientific American:

It may interest you to know that I visited the peridotite locality of Elliott Co., Ky., with Dr. J. S. Diller, of the U. S. Geological Survey, and for the survey, for the purpose of examining it, since it was surmised that diamonds would be found. Diamonds were not found, but we made some interesting observations, which will be published later on. I also visited the place where the 4½ carat diamond was found last summer—*i. e.*, Dysartville, MacDowell Co., N. C.—and saw the boy who found it. Although there are no diamond indications there, I have every reason to believe that it was really found there. On visiting the rock crystal localities in Ashe Co., N. C., I found a number of crystals from 5 to 60 lb., and one large single crystal of 285 lb.

New York, July 6, 1887. GEORGE F. KUNZ.

The Alien Act.

It would be well for our Pacific coast delegation to do all in their power to so amend the Alien act, that was "railroaded" through at the close of the last session, that the mineral lands and mines of our Territories shall be excluded from the effects of this impolitic measure.

"America for Americans" is all very well, and American capital for American mines is something desirable; but, unfortunately for us, our capitalists are, with but few exceptions, not mine investors, particularly in mines of the precious metals. They prefer other classes of securities. Unless the act is amended so as to admit and encourage foreign capitalists on liberal terms to invest in our mines, the result will be that a large percentage of the mines of our Territories will remain undeveloped and dormant until we, as a nation, shall have become mine workers and capital shall have become more abundant.

A very large amount of capital has been already withdrawn by English investors from this country.

No business so rapidly develops a country as that of mining. Towns and cities spring into existence like magic, giving employment to the laborer, artisan, and farmer. The rugged mountain chains and barren wastes seem destined by nature as the metallic domain most favorable for mineral deposits. The country is soon opened up by wagon roads, followed by railroads.

It is a singular fact that while we are throwing obstacles in the way of the introduction of foreign capital, our near neighbors are encouraging the development and settlement of unoccupied land, both agricultural and mineral, by building railroads, and by liberal measures the Canadian Pacific Railroad on the north bids fair to be a serious rival to our system of railroads that span the continent. On the south our sister republic (Mexico) has thrown wide open her doors and offers every inducement to both agriculturists and miners to colonize her vast territory and develop her mineral resources. Her colonization laws are liberal. The code of laws governing her mines are superior to ours in many respects. It is necessary for us also to do something to get people to invest in our mines. The law referred to does not affect the States except indirectly, but the Territories have much to complain of from its enactment.—*Min. and Sci. Press.*

Military Dogs.

Among the thousand and one inventions, appliances, and wonderful uses of men and beasts which German genius has devised to defeat France in case General Boulanger's successor becomes unpleasant, the dog plays a significant role, employed, as he is, as messenger and sentinel. Experiments have been made for nearly a year now, and have proved highly satisfactory. The dog maneuver of the Hunter battalion was decidedly the most interesting of the recent campaign. Several regiments have been furnished with the German shepherd dogs, known for their wisdom the world over. Each one is attached, so to speak, to the person of a soldier, in whom the dog soon recognizes his master, and who conducts his training. While doing duty, the dog is kept with the sentinel, and easily learns the requirements of his post. A few of the experiments performed before Colonel von der Goltz Pacha, who represented the Sultan at the ninetieth birthday of the Emperor, and has since remained to witness the reviews, were surprising. A soldier, taking the dog from the sentinel, marched off on a reconnoitering expedition. After writing his observations, and placing them in a cask about the neck of the brute, the latter was told to return to his master, which he did in an astonishingly short time. One dog employed in this service arrived at his post ten minutes before a mounted Uhlan charged with the same instructions, though the latter rode at desperate speed. But even more than this was accomplished. With a message tied about the neck, as in the former case, the dog was told to seek a distant sentinel and bring a return answer. This he did with great speed, carrying his message directly to his master without fail. It is little wonder that Pacha Goltz was surprised at the success of the experiments given in his honor. And they are truly wonderful for the present, though bidding fair to become a commonplace institution in that great machine, the German army. The consequences and possibilities of the shepherd dog service are apparent to all who know anything of military science, and make their citation superfluous. One thing is certain, that a future war between Germany and any of its neighbors will not be conducted without its dog regiment, which, though not employed in concerted action, will perform service more valuable than the cats of ancient Egypt.—*Correspondence Tribune.*

Many Items of Interest.

The *American Artisan* says that graphite is an excellent substitute for red lead in making joints and connections in steam and gas fittings. The graphite mixed with the best boiled oil makes a much better joint, and it is claimed will remain tight three months or three years, and will then yield to the ordinary pressure of the tongs, whereas the red lead once set, it is next to impossible to open the joint without damage to the pipe or tongs. The graphite should be pure and of the right grade of fineness.

The *Boston Journal of Commerce* says: The best way to locate a pound in the connections of an engine is to put it on the center, and then let somebody admit steam to each end of the cylinder alternately, keeping the engine on the center all the while, while you are looking up and down the connections for lost motion. If the engine has no means of operating the valve by hand, disconnect the eccentric rod and rig a lever on the end of the valve stem.

A new method of securing veneer to its base consists in spreading glue or other adhesive matter between the veneer and the base, passing the two secured parts under a heated roller to melt the glue and cause it to enter the pores of the wood, then finally passing the connected base and the veneer under chilled rollers to harden and set the glue, and prevent the warping or shrinking of the veneer consequent upon the gradual cooling or drying of the glue.

When copper is to be soldered, and the solder is to be colored like the surrounding copper, the *Jewelers' Journal* says: This can be done by moistening the solder with a saturated solution of vitriol of copper, and then touching the solder with an iron or steel wire. A thin skin of copper is precipitated, which can be thickened by repeating the process several times. If a brass color is desired, a saturated solution of one part of vitriol of copper is used on the previously coppered solder, and the latter rubbed with a zinc wire. To gild the soldered spot, it is first coated with copper in the manner indicated above, and then with a gum or isinglass, and powdered with bronze powder. The surface is thus obtained, which after drying can be very brightly polished.

Governor Hill has signed the bill passed by the New York Legislature regulating the heating of steam cars, and it is now law. The statute makes it unlawful for any steam railroad after May 1, 1888, to heat its passenger cars on other than mixed trains by any stove or furnace kept inside the cars or suspended therefrom, except it may be lawful in case of accident or other emergency temporarily to use any such stove or furnace with necessary fuel. Provided that in cars which have been equipped with apparatus to heat by steam, hot water, or hot air from the locomotive, or from a special car, the present stove may be retained to be used only when the car is standing still, and provided also that this act shall not apply to railroads less than fifty miles in length, nor to the use of stoves, of a pattern and kind to be approved by the Railroad Commissioners, for cooking purposes in dining room cars.

This is the age of paper, and the *Western Manufacturer* suggests that an exhibition of paper objects and manufactures would fittingly commemorate the bicentenary of the first paper mill in this country, next year, to be held at Philadelphia, the birthplace of the trade. Paper is the receptacle and disseminator of science, the products of art and literature, the great means of keeping industries and commerce thriving. It barrels our flour, wraps our goods, enters into articles of personal wear and household use, and when we die sometimes forms our coffins. It rolls beneath our railway cars and forms our buggy tops. We eat off it, drink from it, wear it on our heads, necks, bosoms, and feet, carry it in our pockets in lieu of handkerchiefs, and tile our houses, line our carpets with it, pack up our goods in paper boxes, and divert our leisure moments with paper cards. We make 500,000 tons yearly, import largely, and yet, like Oliver Twist, ask for more. Rags, wood pulp, straw, old rope, the bark of the cotton plant, and even the membranes in the interior of silkworm cocoons, yield it.

The well known Perry Stove Manufacturing Co., of Albany, N. Y., have established extensive works at South Pittsburg, Tenn., covering six acres of land and employing upward of five hundred men. To give young men the opportunity of learning the trades of moulders, mounters, polishers, nickel platers, carpenters, pattern finishers, etc., etc., they have engaged fifty of the best mechanics to teach those who want to learn, and promise liberal wages while they are learning the trade. This would seem like a good opportunity for active young men desiring to learn a useful and profitable trade.

There will be held in Paris, beginning on the 27th of August and lasting until the 28th of September, 1887, an exposition of useful insects and their products, and of noxious insects and specimens of their injuries. This exposition is conducted by the Societe Centrale d'Apiculture et d'Insectologie, under the patronage of the Ministre de l'Agriculture. There is also to be given in this exposition a place for insecticides, and various devices for destroying insects. It is to be opened to foreign as well as French exhibitors.

The Fastest Passenger Steamer Afloat.

The Queen Victoria, the pioneer vessel of the new line intended to ply between Liverpool and the Isle of Man, lately arrived in Liverpool. This vessel, with her sister ship the Prince of Wales, will form the Manx line of the Isle of Man, Liverpool, and Manchester Steamship Company. The vessels, which have been built by the Fairfield Ship Building Company, are both of extremely handsome model, and are fitted with engines of proportionately large power. The dimensions of both vessels are as follows: Length over all, 340 ft.; breadth, 39 ft.; moulded depth to upper deck, 24 ft.; gross tonnage, about 1,500 tons. The vessels are each divided by bulkheads into nine water tight compartments. The water tight doors between the engine and boiler space are constructed with the angular lever self-closing arrangement, which the Fairfield Company are now fitting into most of the vessels built by them. On a clutch being actuated, either from the stoke hole or from the deck, the door automatically closes, advancing slowly at first, and then shutting sharply, cutting through any coal that would otherwise impede its passage. A heavy mass of lead, suspended from a lever, supplies the motive power. The upper deck is exceptionally spacious, affording a promenade the full width and length of the ship. The main deck also affords a roomy promenade. The general fittings of the vessel have been carefully devised, and every expedient for the comfort and safety of the passengers has been adopted.

The engines of the Queen Victoria are of exceptional power; they are expected to indicate 6,000 h. p., and to propel the vessel at the rate of 20 knots, equal to 23 miles, per hour, on regular service. They are compound diagonal and direct acting, having two cylinders and surface condenser. The high pressure cylinder, which is placed uppermost, is 61 in. in diameter, and the low pressure beneath it is 112 in. The valves are actuated by the usual double eccentric and link motion. The main working parts of the engines are made of steel, the shafts and crank pins being made hollow. The paddle arms and feathering floats are made of steel. The boilers are double ended, and are supplied with forced draught. The fans are placed one on either side, over the boilers, and are driven by a small high speed engine situated between them.

The Queen Victoria sailed from the Tail of the Bank, Greenock, to Liverpool, in the remarkably short time of nine hours twenty-three minutes, representing an average speed of 22¼ knots, or 25·62 miles, per hour.

An Electric Headlight.

The *Master Mechanic*, in connection with a description of an electric headlight used on Lake Shore & Michigan Southern engine No. 411, and a view, reproduced from a photograph taken at night, showing its effect, says: It will be seen that 23 telegraph poles are visible, but under more favorable conditions 45 poles have been counted, which is equal to a distance of about 1½ miles. A newspaper has been read by the light four miles away, and the time of night has been seen on a watch face nine miles distant. The reflection of the light in the clouds has been noticed 12 miles away. The headlight is the invention of Mr. Howard L. Pyle, and has been in operation between Cleveland and Erie nearly a year, giving entire satisfaction. In snow-storms it is noticed that the snow and sleet melt the instant they touch the glass, which is kept warm by the light. The locomotive runners say that targets, switch-lights, and semaphores can be distinctly seen, and the colors are as readily discernible as by daylight. A man can be seen three fourths of a mile away. The illumination on the track for a mile ahead is so noticeable that it gives good warning to wayfarers of the approach of the train, thus in a measure obviating the necessity of using the bell or whistle. Mr. Pyle is said to have overcome the various obstacles heretofore encountered in experiments of this kind. He uses for motive power a Bailey rotary engine.

SCIENCE IN TOYS.

XIII.

An ordinary glass prism, such as may be purchased for fifty cents, is sufficient for the resolution of a beam of white sunlight into its constituent colors. By projecting the dispersed beam obliquely upon a smooth white surface, the spectrum may be elongated so as to present a gorgeous appearance. It is not difficult to understand that whatever is exhibited in the spectrum must have existed in the light before it reached the prism, but the recombining of the colors of the spectrum so as to produce white light is of course conclusive.

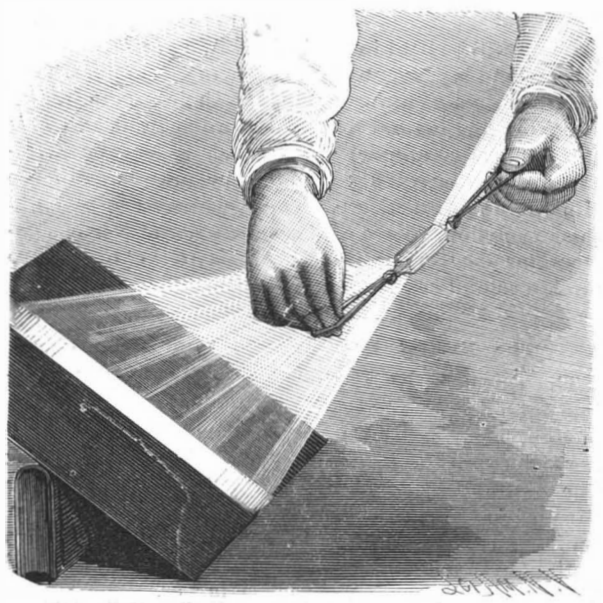


Fig. 1.—SIMPLE ROCKING PRISM.

The colors of the spectrum have been combined in several ways, all of which are well known. Newton's disk does it in an imperfect way by causing the blending, by persistence of vision, of surface colors presented by a rotating disk. Light from different portions of the spectrum has been reflected upon a single surface by a series of plane mirrors, thus uniting the colored rays forming white light. The colored rays emerging from the prism have been concentrated by a lens upon a small surface, the beam resulting from the combination being white. Besides these methods, the spectrum has been recombined by whirling or rocking a prism; the movement of the spectrum being so rapid as to be beyond the power of the eye to follow, the retina receiving the impression merely as a band of white light, the colors being united by the superposing of the rapidly succeeding impressions, which are retained for an appreciable length of time.

The engravings show a device to be used in place of the ordinary rocking prism. It is perfectly simple and involves no mechanism. It consists of an inexpensive prism, having attached to the knob on either end a rubber band. In the present case the bands are attached by making in each a short slit and inserting the knobs of the prisms in the slits. The rubber bands are to be held by inserting two of the fingers in each and drawing them taut. The prism is held in a beam of sunlight as shown in Fig. 1, and with one finger the prism is given an oscillating motion. The band of light thus elongated will have prismatic colors at opposite ends, but the entire central portion will be white. To show that the colors of the spectrum pass over every portion of the path of the light, as indicated by the band, the prism may be rocked very slowly.

By inserting four screw hooks in a standard and stretching the bands over the hooks as shown in Fig. 2, the prism is adapted for use in connection with a lantern. The light emerging from the lantern must pass through a narrow slit to secure a perfect spectrum, and between the screen and the prism should be placed a screen with an oblong aperture, which will allow all of the band of light to appear upon the screen with the exception of the colored extremities. With the prism supported in this way, it is an easy matter to turn it slowly back and forth, showing on the screen the moving spectrum, which, with the more rapid movement, produces the pure white band. G. M. H.

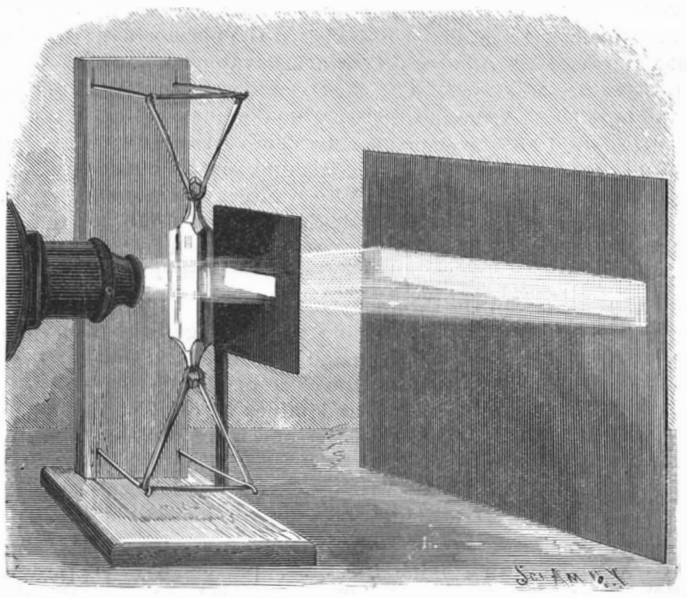
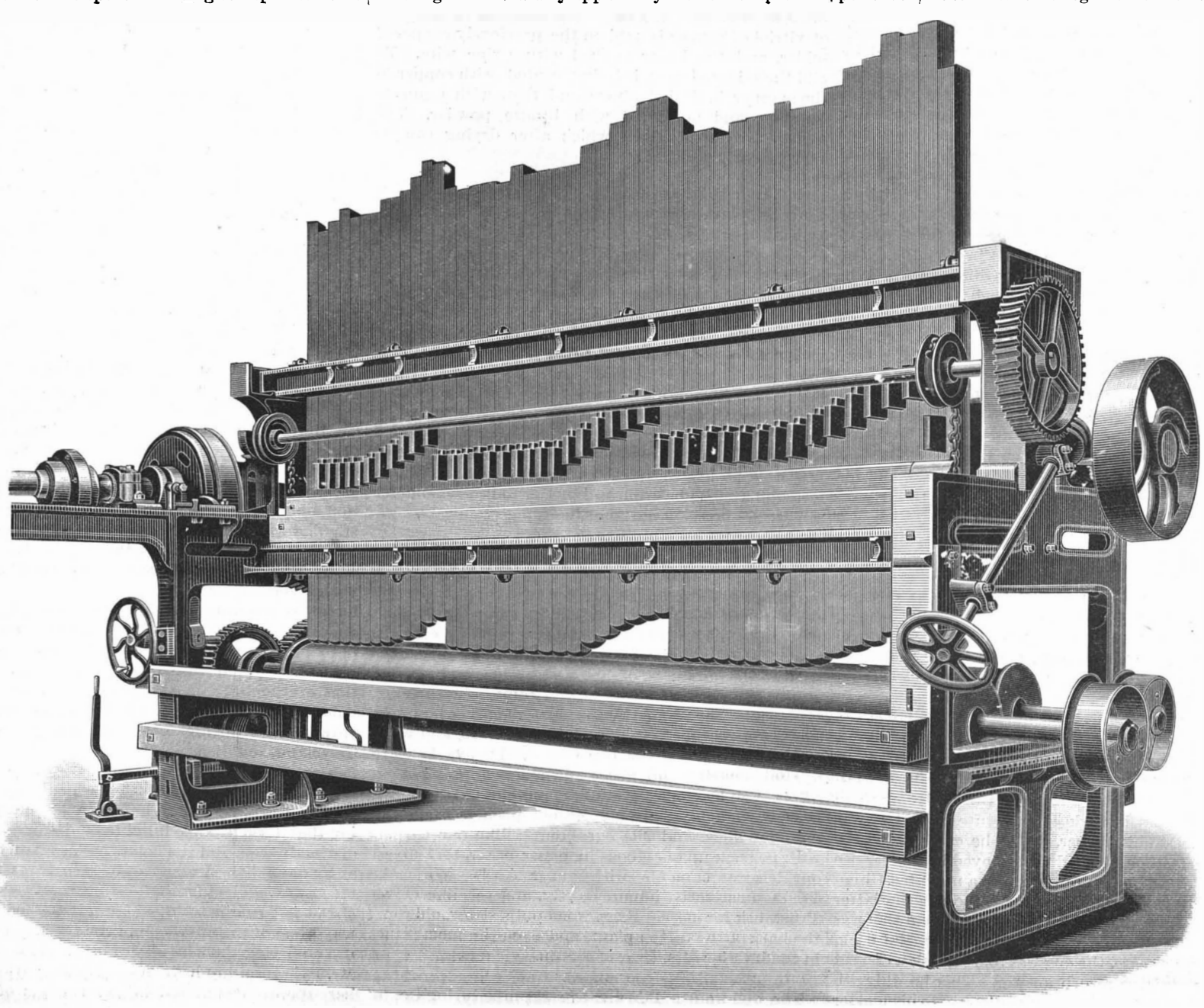


Fig. 2.—ROCKING PRISM ADAPTED TO THE LANTERN.

BEETLING MACHINE.

Among the exhibits at the Manchester Exhibition none is more sure to attract attention, when at work, than the beetling machine exhibited by Messrs. J. H. Riley & Co., of Elton Iron Works, Bury, and which is here illustrated. Not only is a beetle one of the noisiest of machines, making its presence felt at a distance, but the process which it is employed to carry out is one which excites great interest in the stranger, as it deals with fabrics to be found in every household, treating them in a way apparently better adapted to insure their destruction than to effect any improvement in their condition.

The cotton cloth to be beetled is wound on a long roller, called a beam, several pieces being wound side by side, but with a space of a few inches between the edges or selvedges of the adjacent pieces. This beam is then placed under a row of fallers, made of beech wood, and arranged to have an 11 inch drop. By means of an equal number of three-armed wiper cams, which are not shown in the engraving, the fallers are alternately raised and dropped on to the cloth, the beam being slowly rotated and reciprocated endwise at the same time. This pounding operation has two effects on the cloth. First it spreads it sideways, increasing its width in a way which is more permanent than any other process in vogue for this purpose. The non-textile reader may be inclined to ask why the cloth is not made the proper width in the loom, so as to avoid the need of a separate operation. Unfortunately, nearly all the processes to which cloth is subject tend to make it narrower. In the first place, the act of beating up the weft in the loom draws the warp threads together from 5 to 10 per cent; then in bleaching, the tension of the drawing rollers on the softened fibers continues this process, and a further loss of width is experienced, which has to be regained either by beetling



IMPROVED BEETLING MACHINE FOR FINISHING CLOTH.

or by a stretching machine. To manufacture the cloth an extra width to allow for the losses would entail increased expense, and would fail of the object, for a shrunken cloth would be different in texture and "feel" to one restored to its natural width.

But beetling is never undertaken for the sole end of stretching cloths, as it is too expensive a process. Its chief purpose is to give a "finish" which cannot be obtained by any other means, although very many attempts have been made. As each faller descends it flattens the yarns on which it impinges, and at the same time produces a slight motion of the various layers upon one another, the result being that the threads are given a distinctness and a brilliancy which is characteristic of linen, and with which every one is familiar in the white pocket handkerchief of daily use. It is only in high class goods that the process of beetling can be carried out, for it is slow, and takes very considerable power. For cheaper cloths, the stretching machine and the calender are made to suffice.

Referring to the engraving, it will be seen that there are two beams, either of which can be placed under the fallers while the other is being filled or stripped, as the case may be. The fallers can all be raised out of range of the wipers by means of a cross bar lifted by chains and drums from a shaft operated by worm gear and a hand wheel. The wiper shaft is driven by bevel gear through a friction clutch.—*Engineering.*

CHARLES FREDERICK CHANDLER.

BY MARCUS BENJAMIN.

The early history of chemistry reads with the fascination of an Oriental tale, for out of alchemy came chemistry. It seems as if there were giants in those days, for with rude implements and impure reagents great results were obtained. Honor and distinction came to those who followed the new-born science. An apothecary's clerk became the great Scheele; the medical student was made Baron Berzelius; the boy who walked to Paris developed into the mighty Dumas, famous as the great lecturer and cabinet minister; and then Hofmann, once a poor student in Liebig's laboratory, discovered the aniline colors, and was called to fill the most important of all scientific offices in the German empire, that of a professor in the University of Berlin.

The history of American chemistry shows no such conspicuous illustration of phenomenal success, but in the annals of that science in this country there will be found many names that have been made illustrious by ability and research. The discovery of oxygen was made by Priestley, whom we claim as our own. The oxyhydric blowpipe was invented by Robert Hare, in Philadelphia; Samuel Guthrie was the first to give chloroform to the world, and Charles T. Jackson followed with ether, and so on until recently, when saccharin was discovered by Ira Remsen and Charles Fahlberg in the chemical laboratory of the Johns Hopkins University, and a new process for the reduction of sodium invented by Hamilton Y. Castner, in New York. America has, indeed, great reason to feel proud of the work that has been accomplished within her boundaries.

Personal influence has had much to do with this. The elder Silliman gathered around him many of the scientists of a former generation, most of whom have since passed away. The elder Draper likewise attracted to his lectures students who have enriched science with their discoveries. Of later date is Louis Agassiz, from whom nearly all of the American naturalists of to-day received their inspiration, and it is from him that Professor Chandler first received his fondness for natural science.

Charles Frederick Chandler was born at the residence of his grandfather, Nathaniel Chandler, in Lancaster, Mass., on December 6, 1836. His paternal ancestors were descended from William Chandler, who came from England in 1637, and settled in Roxbury, Mass. On his mother's side he came from John Whitney, an old Boston merchant.

The curious chiastolites and the lithium minerals, spodumene and petalite, which he gathered in the vicinity of his grandfather's home in Lancaster, whither he went to spend his vacations, were evidences of his interest in practical science, and were perhaps the first indications of that collecting mania which he has since put to so excellent a use in his museum of applied chemistry in the Columbia College School of Mines, New York. As he grew up he attended lectures on scientific subjects, and among others those by Agassiz. The latter seemed to have determined his career, for the old workshop in the attic was transformed into a laboratory, where, with improvised apparatus and kitchen chemicals, his first experiments were made.

Regular studies, however, were not neglected, and in due time Chandler graduated at the high school in New Bedford, and then after a year's private study of the advanced classics, began his professional education by entering, on September 1, 1853, the Lawrence Scientific School of Harvard University. In this institution he received instruction in chemistry from Eben N. Horsford, geology from Louis Agassiz, and mineralogy from Josiah P. Cooke.

But a chemist in those days needed the prestige of a course of study under the German masters, and so Chandler went to Europe. At first he entered the University of Göttingen, where he studied chemistry under Wöhler, the pupil of Berzelius, and in 1856 received from that institution the degree of doctor of philosophy for his researches in mineralogical chemistry. His inaugural dissertation, printed with that peculiar Roman type used in Germany, has a colored paper cover, with the imprint "Gottingen, 1856," and contains the eleven following papers: 1, Zircon from Buncombe County, N. C.; 2, Sassurite from Zobten; 3, Stassfurthite from Stassfurt; 4, Analysis of a rock resembling talcose slate, from Zipser; 5, Columbite from Middletown; 6, Columbite from Bodenmais; 7, Tantalite from Chateloube; 8, Yttrotantalite from Ytterby; 9, Samarskite from the Ural; 10, Experiments on the Cerium Metals; 11, Artificial heavy spar.

From Göttingen he went to Berlin and became the private assistant of Heinrich Rose, having as his associate the now celebrated Arctic explorer, Nordenskiold. He spent nearly a year in Berlin, studying also physics under Dove, applied chemistry under Magnus, and mineralogy under Gustav Rose.

On his return to the United States, in 1857, he was

C. F. Chandler

invited by Charles A. Joy to become his assistant at Union College, and a few months later (April, 1857), when Professor Joy was called to the chair of general chemistry in Columbia College, Chandler succeeded to the vacancy at Union, being thus an actual professor before he had attained his majority.

For eight years he continued in charge of the laboratory in Schenectady, also lecturing to the college classes on general and agricultural chemistry, mineralogy, and geology.

In 1864, at the suggestion of Prof. Joy, he was invited to come to New York City and take part in the formation of the School of Applied Science, now known as the Columbia College School of Mines, then about to be established under the direction of Professors Thomas Egleston and Francis L. Vinton. The department of chemistry was assigned to him, and without salary he began the delivery of the lectures on qualitative analysis, stoichiometry, quantitative analysis, applied chemistry, and geology. In 1865 he received the title of professor of analytical and applied chemistry, and became dean of the scientific faculty. The arrangement of the large qualitative, quantitative, and assay laboratories was developed under his guidance, and he continued in the active administration of these departments until 1877.

Meanwhile new buildings had been erected, and in lieu of a few students, classes numbering upward of fifty were receiving instruction, not from a handful of professors, but from a large and efficient faculty. This institution had become the greatest mining school of the United States. The departments of chemistry, assaying, mining engineering, and metallurgy have no superiors, and but few equals, in the country.

The school was reorganized in 1877, and the chair of general chemistry given to Professor Chandler, since when he has delivered the lectures on general chemistry to the students, not only in the School of Mines, but likewise to those in the School of Arts, and also the lectures on applied chemistry.

His work on the last named subject deserves special recognition. Professor Chandler at once recognized the importance of this branch. Appreciating the value of having educated chemists in various departments of the industrial pursuits of the country, he made himself thoroughly familiar with those subjects, visiting various factories and collecting specimens to be used for class room illustration. The latter now form his museum of general and applied chemistry, in which his specimens illustrating the manufacture of pottery and of the various photographic processes are probably unique.

In 1875 the department of chemistry and its applications in Johnson's New Universal Cyclopædia was placed under his control, and the resulting articles from his pen contributed to the four volumes issued since that year are unequaled in any work of similar character.

Professor Chandler has obtained recognition as having no superior as an authority on technical chemistry. His reputation extends throughout the United States, and he has been very frequently called into court as an expert to testify on matters pertaining to this specialty. Indeed, no case of great importance would seem complete unless his services were retained on one side or the other.

To return to his lectures, in 1872 he became adjunct professor of chemistry and medical jurisprudence in the College of Physicians and Surgeons, the medical department of Columbia College, and in 1876 succeeded to the full professorship.

Soon after his advent to New York City he was asked to assist in the development of the New York College of Pharmacy, and in 1866 he became professor of chemistry in that institution, giving two lectures an evening, twice a week, during the college term. Through his active interest this school has become one of the most flourishing and advanced colleges of pharmacy in the United States.

In 1866 Professor Chandler was invited by the Metropolitan Board of Health to make scientific studies of sanitary questions affecting the health of New York City. There was no appropriation for this purpose, and he performed the work gratuitously. The authorities were so well satisfied with the importance of this undertaking that, at the end of the year, they created the office of Chemist to the Board of Health, and appointed Professor Chandler to the place, which he then held continuously until 1873.

His work while in this office was of the utmost importance, and it has resulted in enormous benefits to the community, concerning which comparatively little has ever been fully appreciated.

The food supply was one of the first subjects to which he turned his attention. Chemical analysis showed that the milk sold in New York City contained on the average one-third of water, or, in other words, frauds to the amount of $10,000 a day were perpetrated by the milkmen. After years of contention, during which several cases were tried in court, the action of the health board was finally sustained by the Court of Appeals, and thereafter the rigid inspection of milk became possible. The value of this reform is most apparent when it is recollected that a milk diet constitutes the principal food supply of fully 200,000 children under five years of age.

The sale of inferior qualities of kerosene, with resulting accidents, was one of the subjects very thoroughly investigated by Professor Chandler. Samples of this burning fluid, sold under various names, were collected and tested. In consequence of its almost uniform inferior quality, legislative action was obtained, fixing a definite burning point, below which nothing was permitted to be sold.

Intolerable odors resulting from the use of lime in the gas works were prevalent at various points in the city. Professor Chandler recommended that the process employed by the gas companies be modified, so as to prevent a continuance of this nuisance, and after a prolonged contest before a referee, his purpose was accomplished.

In 1873, the Board of Health, as now constituted, was organized, and Professor Chandler appointed its president by Mayor Havemeyer. Four years later, he again received the office at the hands of Mayor Ely. In 1883, Mayor Edson presented his name to the Board of Aldermen, but this body rejected the nomina-

tion, and General Alexander Shaler succeeded to the office. Professor Chandler declined the office in 1887, subsequent to the removal of General Shaler by the Governor.

The *Sanitary Engineer*, in urging upon the aldermen the desirability of reconsidering their action, said, in May, 1883: "At the present time it is probable that there is no other city in the world which has so complete a sanitary organization as New York." It is needless to say that this condition of affairs was the direct result of the wonderful executive ability possessed by Professor Chandler.

Under his administration as the official head of the board, the same energetic warfare was continued against existing nuisances.

One of the first of these to be taken up was the odors emanating from the rendering of offal and dead animals. Various establishments where this obnoxious pursuit was carried on were closed, and finally the entire business was restricted to Barren Island, whither all objectionable material was transported, according to laws enacted at the suggestion of the health authorities.

The slaughter houses, originally scattered through the city, were compelled to locate within narrow precincts on the river front, and placed under thorough sanitary supervision.

The driving of cattle through the city was prohibited by law, and thus owners were compelled to transport all live stock by boats, around the island. The sanitary disposal of stable manure and night soil were reforms of considerable importance effected by him. Petroleum refining and other objectionable trades were forced out of the city.

His raid on Washington Market, in 1873, is a well recollected event. This building was surrounded by structures which covered half the roadway of the public streets, and, after exhausting all peaceful measures, one evening Professor Chandler led a force of one hundred and fifty carpenters and laborers, three hundred policemen, and a corps of surgeons to the locality. Before morning the buildings were leveled, the materials carted away to the corporation yards, and the pavements, which had not seen the light of the sun for twenty years, swept clean. Similar action was taken with the stalls around Fulton, Center, and other markets.

The improved management of contagious diseases, the introduction of a separate vaccination corps, the system of disinfection, and the summer corps of physicians, were prominent innovations during his term of office.

Professor Chandler obtained the passage of a tenement house act, which provided that plans of every such building to be erected within the city limits must first be submitted to the health authorities. With this should be included the legislation compelling the regular inspection of the plumbing and drainage of every building about to be constructed in the city. In this manner improved accommodations, with adequate light and ventilation, have been secured for the poorer classes.

It has been shown that the death rate of children under five years of age has been reduced 5,000 yearly, and a further estimate indicates that at least 8,000 lives have been saved annually, and for every death there are twenty-eight cases of severe illness, or 184,000 cases each year. These results are in direct consequence of the sanitary reforms and improvements introduced in New York City by Professor Chandler and his associates on the Board of Health.

In 1879 the New York State Board of Health was established. Professor Chandler was appointed one of its members, and became the chairman of the sanitary committee. Much of the excellent work on the adulteration of food executed by this board during the first years of its life was accomplished under his supervision.

Professor Chandler's name has been associated with others on important papers sent out by the National Board of Health, notably that on the "Instructions on Disinfection," of which report he was chairman of the committee appointed for its preparation.

To one whose time has been necessarily so largely occupied with duties as a teacher, and in public capacities, but little could be expected in the line of original investigation in pure chemistry. Indeed, there has been a disposition among certain chemists to criticise the work of Professor Chandler as being unworthy of the dignity of the Professor of Chemistry of Columbia College, claiming that little, if any, original research deserving that title had been accomplished in his laboratories; but such critics forget his masterly investigations of the water supply of leading cities—work that has not only been found worthy of great praise in the United States, but which has gained distinction for him wherever the subject of water analysis has been studied.

His examination of the water supply of the cities of Albany in 1873 and 1885, Brooklyn in 1868 and 1870, New York in 1866 and almost yearly since, and Yonkers in 1874, his analyses of the springs and artesian wells at Ballston in 1870, Saratoga Springs in 1863 and repeatedly since, including fully twenty extended analyses, Staten Island in 1871, Mount Vernon in 1886, and elsewhere, also his report on water for locomotives in 1865, are valuable contributions to scientific literature, and date back to a period when but little of that class of work was performed in the United States.

Besides the foregoing, many of the analyses of minerals, made for the geological surveys of Iowa, Michigan, Wisconsin, and elsewhere, were performed in his laboratory, also a great number of commercial and confidential chemical investigations have been executed by him.

In 1870, in connection with his brother, Professor William H. Chandler, of Lehigh University, he established the *American Chemist*, a journal that continued for several years. In addition to the original papers from chemists residing in the vicinity of New York, and also laboratory communications from prominent universities, there were a valuable series of abstracts prepared monthly by able compilers, who, with great care, examined the leading foreign exchanges. To its columns Professor Chandler contributed his own papers treating on the chemistry of foods and other sanitary subjects. Although probably the best journal of its kind ever published in the United States, it came to an end in 1877, from want of adequate financial support.

Professor Chandler is an effective popular lecturer, having an excellent voice, and a clear, direct, and vigorous style of delivery. He has appeared before large audiences in most of the leading cities, and especially in New York, where his lecture on "Water," before the American Institute, in 1874, and on "Photography," before the New York Academy of Sciences, in 1879, were enthusiastically received.

In 1874 he was called to preside over the convention of chemists gathered at Northumberland, Pa., to celebrate the anniversary of the discovery of oxygen by Dr. Priestley. The initial movement toward this celebration was made in the *American Chemist*, and full reports of the proceedings subsequently appeared in that journal. It resulted in the formation of the American Chemical Society, of which Professor Chandler is a life member, and held the office of president in 1881.

He is also a life member of the chemical societies of London, Paris, and Berlin, a member of the Society of Chemical Industry, a fellow of the New York Academy of Sciences, of the American Association for the Advancement of Science, the American Philosophical Society, the Sociedad Humboldt of Mexico, and other less celebrated scientific bodies.

In 1874 he was elected a member of the National Academy of Sciences. He has been a member of most of its committees appointed for the consideration of subjects in applied chemistry, such as that on waterproofing of the fractional currency, in 1876; on the preservation of the writing of the original Declaration of Independence, in 1878; sorghum sugar, in 1882; on glucose, in 1883; and on the tariff classification of wool, in 1886.

Professor Chandler received, in 1873, the honorary degree of M.D. from the University of New York, and that of LL.D. from Union College during the same year.

He has taken a prominent interest in all affairs pertaining to the development of New York City, and he is a member of the Century, University, and Union League Clubs.

At the beginning of this sketch, reference was made to Dumas. There is much in Professor Chandler's career that is similar to that in the life of the great French chemist. Dumas came to Paris when he was 23. Chandler's life work began at Union when he was 20; Dumas was 29 when he became the leading spirit in the establishment of the Ecole Central des Arts et Manufactures, while Chandler was only 28 when he came to New York to aid in the founding of the School of Mines. Chandler, like Dumas, has been called to fill important municipal offices and to lecture in other institutions besides the schools with which he was chiefly connected.

Is it too much to hope that, like Dumas, he may yet be called to fill some high national office? As he has been successful in directing the sanitary interests of a great metropolis, surely he can be trusted with larger interests, where, by the application of his scientific attainments, the entire nation may be benefited.

Cement from Blast Furnace Slag.

Three kinds of cement are made from blast furnace slag. The first, which is really more of a mortar than a cement, is produced by taking slag sand and grinding it with 15 per cent of lime and 15 per cent of oxide of iron. The grinding is generally done wet, and the product requires to be used within a few hours of being made, so that its employment is quite local. The second cement is made by grinding 75 per cent of dry slag sand with 25 per cent of dry slaked lime, according to Mr. Larsen's patent. It is essential that the ingredients should be reduced to a fine degree of pulverization, and that they should be intimately commingled. For this purpose the inventor uses a machine which he calls a "homogeneizer." The third cement is made according to a process brought out by Mr. Frederick Ransome. Equal weights of slag sand and chalk are ground together in a wet state, and after being dried are burned either in a kiln or revolving furnace, the process followed being similar to that used in making Portland cement. The following table gives analyses of two of the cements we have mentioned, and also of two examples of Portland cement:

Analyses of Cements.

	Lime.	Silica.	Alumina.	Ferric Oxide.	Ferrous Oxide.	Magnesia.	Water.
No. 1 cement.....	22·9	21·61	19·85	8·80	4	4·36	12
No. 2 (Larsen)..... ...	41·96	24·34	18·74	0·14	0·27	6·57	4·70
Portland (No. 1).....	59·9	24·07	6·92				
" (No. 2).... .	55·57	22·92	8·0				
Middlesbro' slag	40	52·34					
" (No. 2)....	36·88	51·12					
" (No. 3)....	40·45	50·08					

The first and second analyses are by Mr. J. E. Stead. The non-essential ingredients are not given.

From this it will be seen that the first two cements are widely different in their chemical constitution from Portland cement, and they are still more different in their physical condition, for the lime is mostly free, the materials not having undergone the incipient fusion which Portland cement experiences. Now, in the slag the proportion of lime to alumina and silica is about as 39:51, while in cement it as 58:31. Therefore, 100 parts of slag, including the inert matters, requires the addition of 56 parts of lime, or of 100 parts of dry chalk or limestone, to provide the constituents of a good cement, and this is the mixture used in Ransome's process. The result gives a product which exceeds the strength of Portland cement, and which improves by age. Samples seven years old are in existence, and show no signs of deterioration. Of course the process is only commercially feasible in districts where slag is produced, but there it offers a means of turning a useless product into a valuable material, and if it be carried out by Ransome's revolving furnace, the expense for plant is comparatively small.—*Engineering.*

The Use and Care of Chains.

At a meeting of the Society of Civil and Mechanical Engineers, on the 27th of April, Mr. H. Adams, M. Inst. C. E., in a paper on "The Use and Care of Chains for Lifting and Hauling," divided chains into two classes—those with oval links and those formed of flat bars or plates; the former being subdivided into "common" and "short linked" chains. The latter, being of the most importance, received the principal attention. It was pointed out that the links being well rounded, each one acts as a spring when the load surges, and hence their universal adoption for lifting purposes.

The dimensions of the links are, for the extreme length and breadth, $4\frac{2}{3}$ and $3\frac{1}{3}$ times respectively the diameter of the iron of which the link is made. In repairing or joining a chain, the new link has to be made a little longer, to give room for welding, as there are two others in it instead of one, as in making a new chain. The various modes of welding were then described, and the peculiar tendency of some chains to twist while in use. Several illustrations of chain fastenings were shown and described; and the modern forms of hooks and shackles were contrasted with those thought to be "nice" some years ago. The strength of chains next received full notice.

It was shown that with Crown S.C. iron of B.B. quality, equal to an average tensile stress of 26 tons per square inch, an elongation of 15 per cent and a contraction at the point of fracture of 20 per cent, the chain should have a strength of double this; but there is usually a loss of 25 per cent from imperfect welding and other causes. Several defects in welding were explained. The author described in detail the system adopted for the care and maintenance of the chains at Messrs. Cory & Son's coaling establishments, where he has been responsible for chains which have lifted upward of 15 million tons of coal in the last ten years, and during this period only one fatal accident occurred from a chain breaking, although the machinery is in use day and night, and the men necessarily work under the cranes.

The inspection and lubrication are very thorough, and each chain will make about 100,000 lifts before it is worn out for lifting purposes. It is then cut up into sling chains, barge moorings, etc., as there are still many years of useful life in it. The author stated that coal dust is not very detrimental to chains, but coke dust is decidedly bad. In summarizing the points of economy in the maintenance of chains, the author said the testing should be moderate, the annealing frequent, the lubrication thorough; and when the wearing is not uniform throughout the length, the chains should be cut and pieced where partially worn, so that when finally discarded each link shall have done its full share of work without overstepping the limits of safety.

Paraldehyde in Insomnia.

Surgeon J. R. Tryon reports the case of a man who had been in the service about twenty-three years, and whose health had always been good until October, 1882, when he became afflicted with insomnia. By change to shore duty during the following year he obtained relief, but on his return to sea service on the Mexican coast the attack returned, together with general debility. In October, 1883, he was detached and sent home. He went to the mountains of North Carolina and remained there until June, 1884, when he was again ordered to sea. During the time spent on shore the insomnia gradually disappeared, but his general health improved slowly, and at the time he reported on board for duty he was far from well, and required tonics.

After several months the attacks of insomnia again recurred. Various hypnotics, sedatives, tonics—in fact, every remedy that promised success—had been used, but only with temporary relief. His habits were good; tobacco, tea, coffee, and everything that might contribute to his affection were excluded. The only discoverable organic lesion was slight hypertrophy of the heart. Urine contained phosphates in excess. About this time he was ordered Horsford's acid phosphate and the compound sirup of the hypophosphites, which, added to longer stays in port, produced some beneficial effect.

"He had himself noticed an account of the action of paraldehyde, and requested that it be tried on him. The first dose was 2 c. c., taken in the daytime, but probably on this account without effect. The second dose was 3 c. c., which produced four hours' sound, uninterrupted sleep, something quite unusual for him. Subsequently, doses from 3 to 4 c. c. were given about twice a week only, after vainly trying for about an hour to sleep without it. These doses have always been found sufficient to produce sound sleep, sometimes for the best part of the night, and never for less than two hours at a time. To avoid a diminution of effect, it has been given only when absolutely necessary, and so far, two, or at most three, doses a week have been sufficient. The sleep is sound, dreamless, and, unlike chloral or morphia, leaves no unpleasant effect. . . . It has a cooling taste, produces a feeling of warmth in the stomach, but has no effect on the heart, pulse, or temperature. His general health since he has been taking the drug, and been able to procure refreshing sleep, has greatly improved; but this may be partially due to the phosphate, which he is still taking."
—*Report Surgeon-General, U. S. N.*

Photo-thermography.

We have received the following communication, together with two pictures on glass, from Mr. George Mason, of Glasgow:

"I send you on to-night a transparency of one of the most wonderful things in the way of impressions I have ever seen. This picture, as you see it, is photographed from a piece of glass that covered an etching on which it must have imprinted itself from the etching behind. However, the etching and the glass in frame were never in contact, as there was an overmount between.

"The etching has been in the frame for some years, and has been hanging in a strong light. Messrs. Lawrie & Son, the fine art dealers here, sold the etching, and on removing it from the frame found the front glass had a faint impression of the picture on it, which we have photographed to send to you. From the transparency inclosed you will see the result. Of course the exposures turn out positives, the glass being negative in impression. The frame was three feet seven inches by three feet. The picture was one foot eleven inches and one foot three inches, the subject *The Pied Piper of Hamelin*. A mount fitted between the picture and the glass.

"Now this glass would be about a sixteenth of an inch away from the etching, and in front of it. Have you any idea how the impression could be taken up? It must have been thrown back from the picture to the surface of the glass again. It is such a curious thing, and probably new to you, that you might be able to make some use of it."

Having carefully examined these truly interesting photographs, we shall endeavor to give a few words of explanation concerning the phenomena.

There is a principle in physics first investigated by M. Ludwig Moser, who in 1842 announced the following fact: "If a surface has been touched in any particular parts by any body, it acquires the property of precipitating all vapors which adhere to it, or which combine chemically with it on these spots, differently to what it does on the other untouched parts." This was the form in which the law was first announced, but further investigation showed that contact was not necessary, mere juxtaposition sufficing. Emanations were found to be given off from one body to another, in virtue of which vapors were condensed on certain parts in preference to others. Moser designated the phenomena as having been produced by "invisible light," but Hunt adopted the more philosophical term thermography, and made numerous and valuable investigations in this department of physical science, which he published in the *Philosophical Magazine* of the period, and elsewhere. Having found that a blackened paper gave more forcible radiations than a white one, he tried the copying of printed matter, and eventually succeeded in doing so, developing the image by various agencies. The specimens received from Mr. Mason possess an exceptional degree of interest, and are by far the best examples we have seen. That their existence is attributable to thermography, however unhappily it may be named as applicable to this case, we have no doubt.—*British Jour. of Photo.*

THE RACQUET TAILED KINGFISHER.

The Obi Island tanyseptera has the head and wing coverts brilliant ultramarine and the rest of the back and wings deep indigo. The entire under surface of the body is creamy white, and the beak vermilion, while the median pair of tail feathers are greatly prolonged, to a length, perhaps, of nine or ten inches in full plumage. They are dark ultramarine in color and very narrow, but terminate in a racquet-shaped expansion of snowy whiteness.

THE RACQUET TAILED KINGFISHER.

I watched the bird sitting on the boughs a few feet only above the ground, motionless but for an occasional rapid movement of the head. Suddenly there was a flash as of a blue meteor descending to the ground, and a moment later the lovely creature had returned to his perch, and sat hammering away at the small crustacean he had found; the whole action reminding me strongly of that of the bee eaters.—*Dr. F. H. H. Guillemard, Cruise of the Marchesa.*

Cleaves' Method of Blue Printing.

At the recent convention of the American Society of Mechanical Engineers, Professor R. H. Thurston thus refers to this process:

"It gives me great pleasure to present to the society a copy of a very large blue print made by Professor E. C. Cleaves, of the Sibley College of Cornell University, by a new method devised by him, by means of which almost any desired size may be made.

"By the common method the larger sizes are difficult to make satisfactorily; the plate glass needed for the apparatus is very costly, and is subject to serious risk of breakage, and the whole arrangement becomes clumsy and difficult of management. By the process adopted by Professor Cleaves no plate glass is required; the apparatus is simple and easily and conveniently handled; and the size and cost of apparatus bear very little relation the one to the other. Any size likely ever to be required in any work of the engineer can be as easily made as the smaller sizes, and the cost and difficulty of construction of the apparatus are never likely to be such as to constitute a bar to the use of this system of printing. There is no practical difficulty in getting up an apparatus to print a drawing ten feet wide and thirty feet long, if it should be found desirable. That here exhibited in illustration of what can be done is three and one-half feet wide and eight feet long, and is probably the largest blue print yet made by any process.

"Professor Cleaves' apparatus consists merely of a cylinder of a length exceeding that of the widest drawing to be reproduced, and of a diameter such that the longest tracing to be used can be wrapped around it with sufficient space to spare to give room for the clamps by which it is drawn into place and held. The cylinder is smoothly covered with felt and the sensitive paper carefully wrapped about it, the tracing to be copied being drawn over the whole and held smoothly in place by spring clamps, which seize its ends. It is found to be easy to lay the tracing smoothly over the surface, and to draw it into contact so perfectly that the work done by this method is even better and more certain than that produced by the ordinary plate glass apparatus, even with the air cushion now so successfully used with it. The print shown has a defect at one corner; but it is the only defective one yet made, and was selected to send simply because it was feared that there might be some danger in sending it by express, and it was preferred to risk this rather than another. It is easy, with a little care and with some practice, to make these prints absolutely perfect, much easier than with glass.

"The apparatus being ready for use, it is mounted on a cradle, supported by its gudgeons, and is revolved in the sun by means of a cord leading from some convenient line of shafting; or it may be turned by hand until the exposure is satisfactorily complete. It requires a little more time to print a sheet by this method than by the old, as the tracing and the underlying sensitive paper is but one-half the time exposed to the rays of the sun. With these exceptionally large prints, however, for which only this process would be employed, this is not an important matter. They are not likely to be made every day."

Patents as Monopolies.

In view of the fierce attacks sometimes made on valuable patents, it is well to remember that they represent a monopoly of but limited duration, and that their very value lies in the economy that they effect in some way for the people who use them. The use of a patented article is in every instance, we believe, a matter of deliberate choice as to a convenience, and not the resort to an absolute necessity. The other side of the "monopolies" is rather neatly brought out in the following from the Omaha *Bee:* "A displeased correspondent of the New York *World* wrote to that paper and asked it to answer, if it could, 'What unpatented American industry is a monopoly in this country?' That journal referred him to the oil and coal industries. If the correspondent wants further information, let him come West, come to Nebraska, and gaze upon the workings of both patented and unpatented monopoly industries. We can show him where railroad companies not only own coal mines, but where they fix a price that is beyond all reason, and make the price within one hundred miles of the mines the same as they charge four hundred miles further east. We can show him where unpatented lime is owned and handled exclusively by one railroad company and peddled all over the State at the same price—distance making no difference. We can show him where salt from great salt works is sold in the same manner. We can show how unpatented dealers get special inducements, and how outrageous freights are charged on unpatented railroads. We could show him 'unpatented American industries which are monopolies,' by reason of the aggressions of great corporations, until his eyes would water, and he would gasp for breath."

After all, the inventor who arrives at great results by years of patient toil and the exercise of his unique talent is a very creditable monopolist, and we wish there were more of his kind. It sometimes happens, too, that large fortunes are acquired by those who obtain an interest in his inventions, but there is little to deplore in that, for they can only grow rich out of the greater economy effected in some special device for public benefit or by some improvement in manufacture.—*Electrical World.*

Hay Fever Cure.

Dr. Moorhead writes, in the British *Medical Journal*, that he has obtained relief from hay fever, his annual persecutor for thirty years, by hypodermic injection of one-twentieth of a grain of morphine and one two-hundredth of a grain of atropin night and morning. The relief was complete.

ENGINEERING INVENTION.

A station indicator has been patented by Messrs. James W. Duffee and Charles Weston, of Washington Court House, Ohio. The invention provides for placing an indicator at each end of each car of a train, all the indicators being connected by pipes with a reservoir on the locomotive or tender, from which compressed air or other fluid is made to operate the indicators simultaneously at the will of the engineer.

MECHANICAL INVENTIONS.

A machine for cutting metal has been patented by Mr. Loring L. Hazen, of Arcola, Ill. It is made mainly of cast iron, with a working or cutting lever operated by an eccentric, and is mainly designed for use in blacksmiths' shops, and to be secured to a bench or post for operation by hand, having also a peculiarly fitted and operating punch.

A ratchet drill has been patented by Mr. Charles Davy, of Sheffield, York County, Eng. It consists of a friction clutch for transmitting motion from the handle to the spindle, consisting of a screw thread of rapid pitch upon the spindle, a nut screwing thereon and or conical form externally, an eye attached to the handle and fitting on the nut and free to rotate, with a spring to force the nut more tightly into the eye.

AGRICULTURAL INVENTIONS.

A lime distributer has been patented by Mr. John Hotham, of Hillside, Pa. Combined with a hopper are two independently geared distributing wheels and a double inclined apron, with other novel features, the machine being calculated to evenly and widely distribute lime or other fertilizer, either fine or lumpy, and to hold a large load.

A harvester cutter bar has been patented by Mr. Daniel B. Detweiler, of Berlin, Ontario, Canada. This invention provides a construction in which the ledger plates of a cutting apparatus are so mounted that they may all be removed at once, without removing the guard fingers or loosening any of their connections or fastenings on the finger bar whereto the guard fingers are secured.

A band cutter and feeder for thrashing machines has been patented by Mr. John H. Spurgin, of Carthage, Mo. It is so constructed that as the bound bundles are fed they are guided beneath knives which cut the bands and then spread by a novel arrangement of tines as delivered to the thrasher, the construction being applicable for use in connection with any of the ordinary forms of thrashing machines and increasing their general utility.

MISCELLANEOUS INVENTIONS.

A stirrup has been patented by Mr. William S. Cardell, of Fred, Chickasaw Nation, Indian Ter. The foot portion has holes formed through its sides in which are incased springs, capable of yielding to the weight of the horseman, and thus take up part of the jarring and jolting caused in riding.

A flying toy has been patented by Mr. John M. Richard, of Newark, N. J. It consists of a bladed wheel and pendent guiding shaft, a handle for the shaft being made with an adjustable spindle, the toy being caused to rise in the air by pulling a string, effecting a rapid rotation of the shaft and its blades.

A bed room sanitary closet has been patented by Mr. Charles Memmert, of Washington, D. C. It is designed to set in the fire board or wall, to extend into and communicate with the chimney or flue, thus forming such a receptacle for the chamber vessel that it will be out of sight, and all odors therefrom will pass up the chimney.

A fifth wheel has been patented by Mr. William C. Engel, of Ashland, Pa. This invention consists mainly in a ball having a connected head or flange plate to which the vehicle spring may be clipped, and a socket connected to a base plate or bar clipped to the axle, the ball fitting in the socket after the manner of a ball and socket joint.

A stump puller has been patented by Mr. John H. Schindly, of Luthersburg, Pa. It has three posts held together at their upper ends, in connection with links, wedge, clevises, and a pulling lever, arranged in such relation to each other that a powerful pull may be effected, and which may be readily regulated according to the resistance offered.

A bean cutter has been patented by Henry A. Grotholtman, of Fort Wayne, Ind. It is for slicing beans for pickling and other purposes, and has a cutting disk revolved by a crank arm and bevel gear, with cutter blades revolving parallel and closely to the lower ends of inclined guide tubes, which receive the beans fed through openings in a circular head.

A washing machine has been patented by Mr. Martin V. B. Watson, of Altamont, Kansas. It has rubbing bars in the bottom of the tub, in which a hollow corrugated cylinder is journaled, the clothes being placed in the cylinder and attached thereto from loops on the outside, when they will be washed by the revolution of the cylinder and by rubbing on the bars.

A device for operating awnings has been patented by Mr. Theophile Charron, of Kankakee, Ill. This invention provides a construction whereby an awning may be readily raised and lowered, and when raised will be wound upon a suitable roller, and thereby protected from the weather and prevented from creasing, while it will be securely held in open position.

A speculum syringe has been patented by Mr. John P. Schenck, of Matteawan, N. Y. The invention consists of movable fingers each carrying a perforated tube, the object being to combine a syringe with a speculum.

A hat wire has been patented by Mr. Herman H. Kellner, of Danbury, Conn. It is of a peculiar triangular shape in cross section, with two straight or flat diverging sides and one convex side uniting the straight sides at the points of their greatest divergency, whereby it will possess considerable strength in the hat rim, and not tend to jump out of place.

A collar stud and necktie holder has been patented by Mr. David Stone, of New York City. It is a stud or button proper provided with a folding shank or back, so arranged that it is designed to facilitate the operation of dressing, and at the same time be comfortable and prevent all chance of the shifting of the cravat.

A frame for pocket books, satchels, etc., has been patented by Mr. Louis B. Prahar, of New York City. It is composed of two jaws, each struck from a single piece of sheet metal, with a narrow portion at one half and a flange at the other half made flush or on the same curve with the narrow portion of the jaw, the jaws being pivoted to brace and protect each other.

A nutshell cutting machine has been patented by Mr. Charles Pecht, of Austin, Texas. It is principally for the use of bakers, confectioners, and others, to release the kernels better than by cracking, and consists in a metallic ring with a series of cutters extending inward radially, and easily adjustable, with a follower adapted to push the nuts through between the cutters.

A curtain pole and fixtures have been patented by Mr. Frank C. Schastey, of New York City. The construction is such that the curtains are opened and closed, and the curtain rings moved along the pole, by the contact of the cord tubes with each other, these tubes being fixed in the lower part of each curtain ring, whereby the curtains will be moved with very little noise and friction.

The construction of vessels forms the subject of a patent issued to Mr. Thomas J. Hanlen, of Macon, Ga. The hull of the vessel is broad, but with a central ∩-shaped bottom, making a channel from stem to stern for free passage of water, this channel having a casing extending up into the hull, and the propeller shaft and propellers being located therein and operated after a novel manner.

A vehicle wheel lock has been patented by Mr. George N. Adams, of Olean, N. Y. It is more particularly designed for children's carriages, and is of the kind where a bolt or catch is combined with the axle, engaging with a plate on the inner face of the hub of the wheel, which, when free, turns loosely on the axle, the invention covering novel features and combinations of parts.

A combination lock has been patented by Mr. Joseph G. O'Neill, of Nevada City, Cal. The invention consists of a sliding bolt frame operated by a lever, a locking frame actuated by the outside knob and the lever, and pivoted tumblers operated by spring keys, the construction being simple and durable, and the lock being adapted to be changed to any desired combination for unlocking.

A station indicator and calendar has been patented by Mr. Francis C. Jones, of Ouachita Parish, La. Combined with an apertured casing are rollers, a belt or band, knobs with notches in their hubs connected to the rollers, and certain other novel features, whereby, when the operator turns the proper roller, the name of the next station will be made to appear, the device carrying also a calendar.

A folding tracing slate has been patented by Mr. William D. Heyer, of Elizabeth, N. J. By this invention a translucent slate is held between hinged opaque slates, whereby a slate pencil may be used upon the roughened surface of the translucent slate and the white lines made will be rendered clearly visible by the dark background, making a desirable surface for tracing and copying.

A ratchet brace has been patented by Mr. George M. Laforge, of Billings, Montana Ter. The invention provides means for converting the device into a double or single armed brace, for locking the ratchet and thus making the brace rigid, and for adjusting the jaws to fit angular portions of different sizes, being generally adapted for use with augers and drills, or as a nut wrench, and for other purposes.

A process of making bread has been patented by Mr. Joseph D. Cox, of Rochester, N. Y. The mixing pan has a cover of some height, whose down projecting rim sits in an annular trough containing water, preventing access of air to the dough, but allowing the escape of gases generated by the dough through the water, whereby the fermentation process in the raising of the bread will be facilitated.

A dust trunk cleaner for cotton openers has been patented by Mr. Horatio W. Fairbanks, of Atlanta, Ga. It is for use with the trunks through which cotton is drawn before delivery to the opener, the invention providing the trunk with cross slats, doors carrying segmental toothed racks, and endless chains having teeth and carrying brushes, to relieve the trunk of sand, dirt, dust, etc.

A manual motor has been patented by Mr. Adam M. Friend, of Rawlins, Wyoming Ter. Combined with a freely vibrating hand lever and a treadle with pawls and toothed wheel is a rotatable shaft on which the toothed wheel is fixed, with other novel features, whereby the weight and strength of the operator may be utilized for propulsive effect in driving machinery and propelling vehicles.

A heat regulator has been patented by Mr. Edward Zickwolff, of Saarbrucken, Germany. It is an apparatus in which a volatile liquid vaporizing at the ordinary temperature is used, the vapors, expanding under a higher temperature, acting upon a column of mercury to operate a device for opening and closing the inlet valve for the heat, thus automatically regulating the admission of heat to a room.

A clothes washer has been patented by Mr. John J. Turner, of Hunter's Point, Long Island City, N. Y. It has a perforated plunger and a mechanism for imparting a reciprocating motion thereto, a central cylinder within which the plunger is reciprocated being entirely or partially surrounded by auxiliary washing chambers, whereby the water will be thoroughly forced through all the interstices of the fabric.

A glass tube cutter has been patented by Mr. Laurence P. Lindgren, of Doniphan, Neb. It consists of a tube cut away upon one side, stopped in one end, and having a central rod supported axially, carrying near its free end a roller glass cutter capable of engaging the inner surface of the tube to be cut, being particularly designed for cutting water gauge tubes of steam boilers to adapt them to their fittings.

An adjustable bulletin board has been patented by Messrs. Hugh C. Cannon and Arthur E. McGrath, of McArthur, O. It consists of a pivotal post and rotary adjustable shaft mounted therein, with guide strips, in combination with a bulletin having interchangeable letters and a drum with ratchet, pulley, and rope for raising and lowering the bulletin, whereby the bulletin may be easily adjusted to any point desired on its post.

A combined land roller and clod crusher has been patented by Mr. Friedrich Twick, of Sheboygan, Wis. This invention covers an improvement on a former patented invention of the same inventor, whereby the scrapers can be more readily adjusted, the colters readily raised and lowered and their bearings oiled, with other novel features, the machine being thus made more convenient in use and reliable in operation.

Waxing paper forms the subject of a patent issued to Mr. Charles A. Wilkinson, of East Somerville, Mass. A box provided with steam pipes has an upper depressed and corrugated surface, with gutters fed by a funnel, in connection with a perforated plate, felt sheets, and a roller; the felt is first thoroughly saturated with melted wax or paraffine, the temperature raised, and the paper waxed by placing the sheets simply on the felt bed, and passing the roller over.

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NEW BOOKS AND PUBLICATIONS.

THE MECHANICS OF MACHINERY. By Alex. B. W. Kennedy. London and New York: Macmillan & Co.

The author, Professor of Engineering and Mechanical Technology in University College, London, has sought herein to make a book specially adapted to the wants, requirements and difficulties of young engineers and students of engineering. It is far from being an elementary work, but rather such a one as would form an excellent aid for the more ambitious students of our technological schools, such as Cornell, the Rensselaer Polytechnic, the Massachusetts Institute of Technology, or the Stevens Institute. This treatise is not as wide in its scope, and does not involve such complicated mathematical formulæ, as the great work of Dr. Weisbach, but it will be found to require diligent application and close thought in the student—a necessity which the young mechanic, be he ever so industrious, generally finds extremely irksome until he acquires the mental habit which comes only of steadily pursued intellectual work. The strong logic, clear analysis, and smooth style of Dr. Kennedy's work will be great help to such young learners, so far as possible making an ordinarily very dry study attractive in itself.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

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Minerals sent for examination should be distinctly marked or labeled.

(1) D. E. M. asks: In a stick of timber 40 feet long, 24 inches square at one end, and 12 inches square at the other end, how many feet of lumber are there? It is also stated that the proposition has been given to several lumbermen in the Chicago Exchange building, who have found various results; among others, the following: 60 feet, 600 feet, 720 feet, 876 feet, 1,080 feet, 1,200 feet, and 2,400 feet; that if the cubical contents of the timber in feet is what is wanted, 1,200 would be the correct answer; but if a lumberman were buying the stick, and desired to find how many feet of board measure there was in it, and put his rule at work, he would find but 1,080 feet, an allowance being made for sawing, or the "kerf." A. For obtaining the solid contents, the rule in Haswell's is for the frustum of a pyramid. Add together areas of the two ends and the square root of their product; multiply sum by height, and take one-third of product. Thus:
4 sq. ft. +1 sq. ft. = 5 sq. ft. + $\sqrt{1\times4}$ = 7×40 = $^{280}/_{3}$ = 93⅓ cb. ft. which ×12 = 1,120 feet board measure without allowing for kerfs and waste. Considering the taper of the timber and allowing for kerf, you cannot make more than 10 feet of lumber to a cubic foot. Then 93⅓×10 = 933 feet merchantable lumber 1 inch thick that could possibly be obtained from the piece.

(2) G. H. B. and others: For answers to your questions, apply rule as above.

(3) Reader.—For description and illustration of the "boomerang" see SCIENTIFIC AMERICAN of January 29, 1887, which we can send you for 10 cents. —The periodicity of fermentative action would depend upon the life history and course of development

(4) D. W. asks the meaning of the word "pitch" when used in connection with screw propellers. A. The distance that the screw would travel in one revolution without slip, or as an ordinary screw follows in the nut.

(5) E. W. writes: Can automatic engines be worked by the heat of the kitchen fire so as to supply electric light by night and to pump water and do other domestic work by day? A. There are devices for utilizing the kitchen fire for raising water. An electric light would probably require too much power for a kitchen appliance.

(6) J. S. G. asks: Do you know of a wash of any kind to prevent sun's rays from shining through stained roll cathedral glass? A church I built seems to be troubled with the sun's glaring rays. If you can give me either a recipe to make or a name by which it can be bought, I will be greatly obliged. A. Try photographers' "ground glass varnish or substitute." This may be too opaque.

(7) H. L., C. G., H. O., and T. L. write: 1. There are four of us making four galvanometers from your paper, December 4, 1886. How can we test it after it is done? A. Place the coil exactly in a central position between the poles of the magnet. Adjust the torsional wire so that the plane of the coil is parallel with the face of the permanent magnet. Adjust the mirror so that it will be in a plane parallel with that of the coil. Project a beam of light from the mirror on to the scale. Arrange the scale so that the light spot will fall on 0° of the scale. Send a weak current through the coil. Note the deflection of the light spot. Now reverse the current and note the deflection. If the two deflections are equal, the instrument is correct and needs no further adjustment. If the deflections are unequal, the correction may be made either by turning the mirror slightly on its support or by swinging the scale. 2. What instrument does it require, if we use the Daniell battery? All we know is the coil gives 150 ohms resistance, as stated in your book. A. You will need to place enough resistance in the circuit to reduce the deflections to the limit of the scale. It is immaterial what the resistance is. 3. What does a volt mean? A. A volt is the unit of electromotive force. It is about equal to the electromotive force of one Daniell cell. 4. What does an ampere mean? A. A current delivered over the resistance of one ohm, by the electromotive force of one volt, is an ampere. 5. I cannot find any book that will guide us. We have made a splendid instrument according to SCIENTIFIC AMERICAN, December 4, 1886. Can you tell me name of book we can get? We have lots of books, but it seems they are too high a grade. We want to make them correct. We have improved on the one with a mirror. A. Thompson's Elementary Lessons in Electricity and Ganot's Popular Natural Philosophy.

(8) Dr. G. L. T. asks the best composition for blacking leather used in tannery. A. The composition and application of the black are largely controlled by the kind of leather, and more depends on its manner of use. It is a trade in itself. A good harness and grain leather blacking is made as follows: Take nine pounds of copperas, a quarter of a pound Epsom salts, and six ounces of acetic acid; thoroughly dissolve together in 1 gallon of boiling water. Take a vinegar or kerosene oil barrel, knock out one head, and put within 40 gallons of cool, soft water (condensed steam is much preferred), then add the above ingredients. Stir well, and it is ready for immediate use, at a cost not exceeding one cent per gallon.

(9) C. B. N. asks the cause of, and a remedy for, ringing in the ears. A. It is frequently caused by the use of quinine, which produces hyperæmia of the tympanum. In any case it is an abnormal condition, which may if it increases produce paralysis, though in its commencement usually light and transitory. If continued, you should consult a physician.

(10) R. F. L. desires (1) a receipt for making polish suitable for polishing pianos. A. A fine varnish is made as follows: Take 700 parts of alcohol, 15 parts of copal, 7 parts of gum arabic, and 30 parts of shellac. The resins are first pulverized and bolted through a piece of muslin. The powder is placed in a flask, the alcohol poured over it, and the flask corked. By putting the flask in a moderately warm place, the solution will be accomplished in two or three days. It is then strained through a piece of muslin, and kept in hermetically sealed bottles. 2. A preparation for whitening ivory? A. Use hydrogen peroxide. See article on this subject in SCIENTIFIC AMERICAN SUPPLEMENT, No. 339.

(11) C. F. M. asks (1) the method of obtaining extracts of flowers. A. Take of the flowers 3 to 5 pounds, proof spirit 2 gallons. Digest for a few days, and then draw over by distillation 1 gallon of essence. For those flowers that are not strongly fragrant, the product may be distilled a second and a third time, or even oftener from fresh flowers. These should be picked to pieces, or crushed or bruised, as their nature may indicate, and should always be selected when in their state of highest fragrance. 2. Is this extract diluted with alcohol before fit to use? A. They are generally diluted with alcohol, depending largely upon what purpose they are to be put to. See Piesse, Cristiani, and others on perfumery, etc.

(12) E. F. R. asks: What is used in laundries in washing clothing to make it so white, kinds of indigo, etc.? Also what is used in getting that beautiful gloss on collars and cuffs which some laundries are used to get? A. See "Laundry Hints," on page 388 in the SCIENTIFIC AMERICAN for December 18, 1886, also "Starch and the Starching Process as used in Laundries," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 577. A solution of gum arabic in water is used to stiffen and impart a gloss to linen.

(13) I. V. M. writes: I wish to glue white holly silhouettes on black walnut, and then oil the walnut. Is there any preparation which I can put on the holly to prevent the oil from soaking into and discoloring, or rather coloring, the holly? A. Give both walnut and holly a thin coating of shellac in alcohol over those surfaces which come in contact before you apply the glue.

(14) G. C. R. asks: When was the first electric street railroad put into practical use in the United States? A. In Baltimore, Md., in 1885; it runs two miles, operates five cars, and last year carried 200,000 passengers. There are about a dozen others now in operation, and as many more under contract, in this country, and about a dozen operating in Europe.

(15) S. I. D. asks how to make water ices. A. Flavor water with the proper extracts, and freeze with agitation as you do ice cream.

(16) W. H. writes: 1. I have a valuable work ready for binding, but through accident one number got stained with linseed oil; how can I remove the stain? A. Apply a little pipe clay, powdered and mixed with water to the thickness of cream, on the spot. Leave it on for about four hours, and then scrape away. 2. How can powder be removed from the skin? A. Grains of powder in the skin must be removed by a surgeon, but will sometimes gradually disappear with new growth. 3. Which is the best journal on electricity? A. There are so many journals now making this subject a specialty that we would not like to decide, unless it were in favor of the SCIENTIFIC AMERICAN and SUPPLEMENT.

(17) J. S. asks how to make the mineral water that is drawn from fountains in the drug stores. A. It generally consists of water charged with the proper salts and with carbonic acid, and requires special apparatus to charge the fountains under pressure. The special mineral waters desired are made by dissolving the ingredients known to exist in the natural water.

(18) L. F. B. asks: 1. How can I clean a number of Carter, Stafford, and Arnold ink bottles, so they would be perfectly wholesome for catsup and such like use? A. For cleaning ink bottles, the best and quickest agent is oxalic acid, bnt it is a violent poison. Try shaking small nails, with water or vinegar, in them, and if this does not answer, use muriatic acid (also poisonous), carefully washing out two or three times after its application. 2. Will you tell me whether I have made on correct principles an induction coil which I describe as follows: Core of soft iron wires No. 16, core 1 inch in diameter, wound tightly with a layer of fish line, whole thickly covered with hot sealing wax about $^{1}/_{16}$ to ⅛ thick, then wrapped twice with No. 16 Edison electric light wire, which has a very good, durable insulation, the whole varnished several times, and covered with several turns of waterproof packing, case lining, and brown Manila paper, and then wrapped, and not very evenly, by hand, with a pound or a pound and a quarter of No. 36 cotton-covered copper wire. I should judge there to be 25 or 30 feet of No. 16 in first coil, wound on core (primary?) A. With regard to your induction coil, you do not give the length. You have apparently used an unnecessary thickness of insulating material. Otherwise it should work quite well. For description of induction coil see SCIENTIFIC AMERICAN SUPPLEMENT, No. 160. 3. How many cells Leclanche battery would be necessary for the above coil? A. Three Leclanche cells would answer for your coil, but they of course would rapidly polarize. 4. How and what to use, to produce a good wax or other polish for cabinet work? A. For wax-polishing woodwork, many receipts are given. We give the following: 1. Dissolve beeswax in cold alcohol to the consistency of butter, and polish by rubbing this on the wood, finishing by rubbing with a clean linen cloth. 2. 8 parts white wax, 2 parts resin, ½ part Venetian turpentine, are heated over a moderate fire, and 6 parts of rectified oil of turpentine are stirred in. After 24 hours' standing, when it should have the consistency of butter, it may be used. The wood should be perfectly clean, and after this is rubbed in, a second rubbing may be given after one-half hour. If necessary, the wood should be cleaned with soap and water and dried perfectly.

(19) F. T. asks: What will remove oil stains from marble statuary? A. Make a paste with fuller's earth and hot water, cover the spots therewith, let it dry on, and the next day scour it off with soft or yellow soap.

(20) J. F. G. asks: Is there any way to generate gas under a high pressure and maintain the pressure while the supply is being exhausted, the same as steam in a boiler? If so, what is the cheapest and best way to do it? How many cubic feet of such gas does it take to equal a ton of coal for heating purposes? What does it cost per 1,000 cubic feet? How much coal does it take an hour per horse power to run a steam engine? A. You can generate gas in a retort under pressure by igniting coal therein, but better results are attained with lower pressure. About forty thousand feet would be required to equal in heating power a ton of coal. It will cost about 75 cents a thousand. For running a steam engine 1½ to 5 or more pounds of coal are required per horse power per hour.

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Proposals for Steel-cast Guns for the Navy.

NAVY DEPARTMENT,
WASHINGTON, D. C., *June* 23, 1887.

Under authority conferred by the act of Congress, approved March 3, 1887, making an appropriation "for the purchase and completion of three steel-cast, rough-bored and turned, six-inch, high-power rifle cannon, of domestic manufacture, one of which shall be of Bessemer steel, one of open-hearth steel, and one of crucible steel," sealed proposals from domestic manufacturers, to furnish the same, will be received at this Department until Tuesday, the second day of August, 1887, at 12 o'clock noon, at which time the proposals will be opened.

Proposals may be made either to furnish three completely finished six-inch, breech-loading, high-power rifle cannon, made from unforged castings, one of Bessemer steel, one of open-hearth steel, and one of crucible steel, or three unforged, rough-bored and turned castings for such cannon, of the same material, respectively, to be finished by the Department in accordance with the bidder's design.

Such finished guns or such castings must be in accordance with the specifications prepared in the Bureau of Ordnance, and each gun, when completed, must be capable of safely discharging projectiles weighing 100 pounds each, with a muzzle velocity of not less than 2,000 feet per second.

No gun or casting for a gun will be paid for until the gun "shall have been completed and have successfully stood the statutory test required by the act of July twenty-sixth, eighteen hundred and eighty-six," entitled "an act making appropriations for the naval service for the fiscal year ending June thirtieth, eighteen hundred and eighty-seven, and for other purposes."

Proposals may be made separately for one or more guns or for one or more castings as aforesaid, but no proposal will be considered unless accompanied by satisfactory evidence that the bidder controls a plant adequate to the production of the gun or guns, casting or castings, which he proposes to furnish.

Each successful bidder will be required to execute, within fifteen days after notice of award, a formal contract in accordance with his proposal, and to furnish a bond, with satisfactory sureties, in a penal sum equal to fifteen per cent. of the amount of his bid, conditioned for the faithful performance of such contract.

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All proposals must be in duplicate, inclosed in envelopes marked "Proposals for Steel-cast Cannon," and addressed to the Secretary of the Navy, Navy Department, Washington, D. C.

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