SCIENTIFIC AMERICAN

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NEW CAB.

The cab shown in the annexed engraving presents many points of novelty, among which are the iron frame, the peculiar form of the running gear, and the springs. The weight of the vehicle is only 775 lb.; this, together with the closeness of the coupling connections, renders the draught very light. It is capable of turning in its own length, and its body is so low and the step is so conveniently arranged that it is very easy to get into or out of the cab. The form of the springs and their connection with the body and with the running gear are well calculated to render it very easy riding.

The large perspective view shows the cab complete, while parts of the running gear are shown in detail in the other figures. Fig. 2 is a plan view, and Fig. 3 a side elevation of the running gear.

The forward axle, A, supports a pair of curved springs, B, which are at the ends, to opposite sides of the frame, C, which is stayed by crossed braces, D, attached to the axle and to the rear of the frame at the corners. The frame, C, is composed entirely of T and angle iron, and supports the fifth wheel, E. The frame which supports the front of the body is also made of T and angle iron riveted and bolted together, forming a very rigid yet very light support.

Perhaps the greatest novelty found in the cab is the method of supporting the body on the rear axle by means of the curved springs shown in Figs. 3 and 4. These springs are novel both as to their form and construction.

The main portion consists of a continuous blade or strip, which is bent so as to form an eye for attachment to the bar or rail secured to the cab body. The two leaves which are formed by bending the steel strip back upon itself are curved upward and forward, forming a loop for receiving the suspension stirrup supporting the vehicle body. The two leaves thus formed are in close contact with each other at or near their junction with the rear axle, but they gradually separate as they extend rearward and upward, and then approach each other again, forming the loop for the suspension stirrup. The extremity of the upper portion of the spring is increased in thickness, forming a butt, which is engaged by a clip on the rear axle which prevents the upper leaf from sliding, and also secures the entire spring firmly to the axle. For light carriages the spring shown in Fig. 3 is used, but when the load is increased additional leaves are placed under it, as shown in Fig. 4.

The method of fastening together the bars forming the running gear is shown in Figs. 5 and 6, and the method of attaching the pole socket and thill fastenings is clearly shown in Fig. 1. The vehicle is adapted for either pole or thills.

This cab is capable of carrying from four to six persons with their baggage. The heavy baggage is carried on the boot or front frame, which is 4 x 4 feet square and arranged so that the baggage can be readily strapped on. The lighter baggage may be carried on the top of the cab.

For simplicity, strength, lightness, and ease in riding, this cab is believed to be unexcelled. It is well adapted for common use and for hotels, and one horse can easily draw it anywhere with its load of five or six persons and their baggage.

The inventor has recently taken several patents for the improvements embodied in this vehicle.

Further particulars may be obtained by addressing the patentee and manufacturer, Mr. C. M. Murch, of Cincinnati, O.

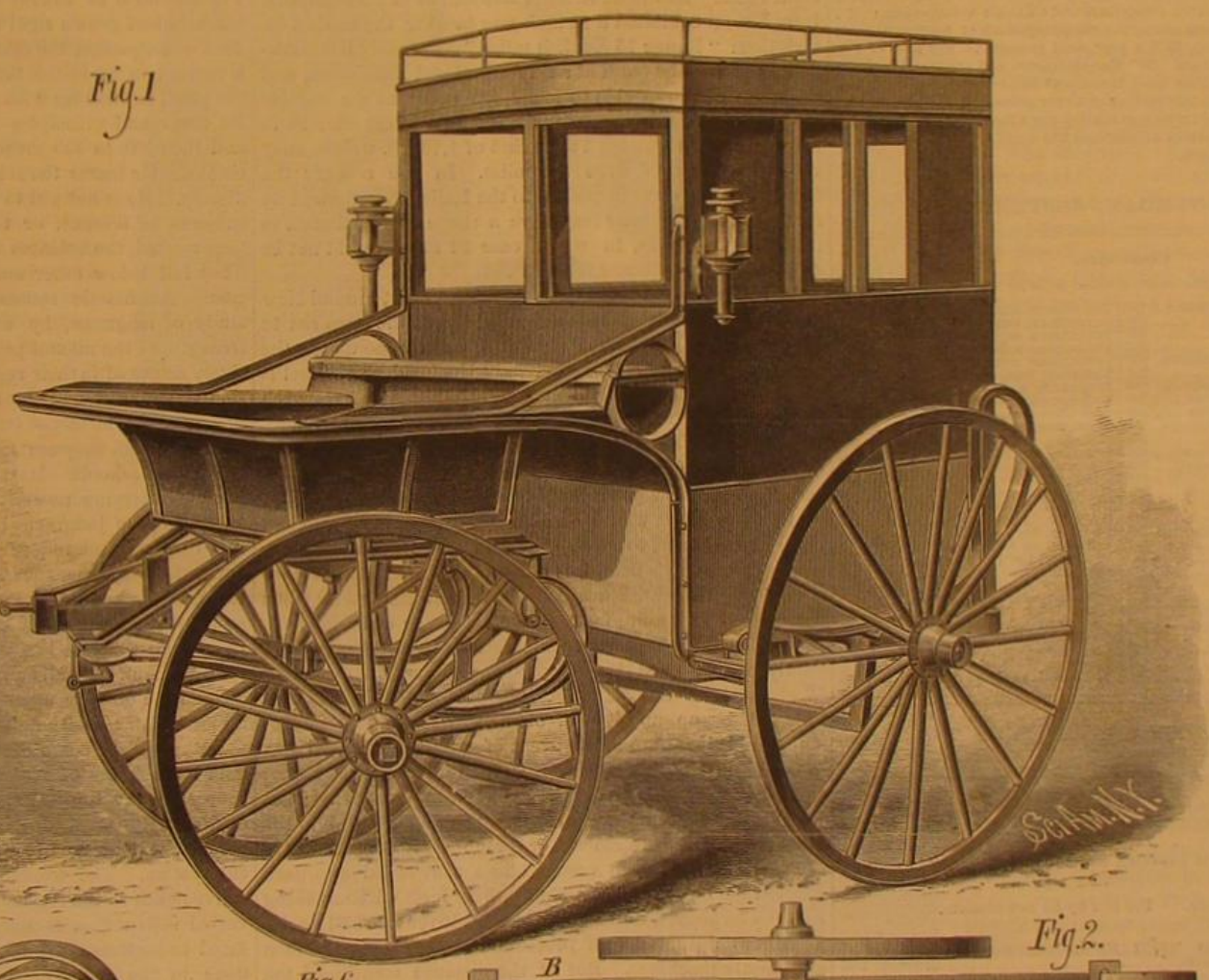
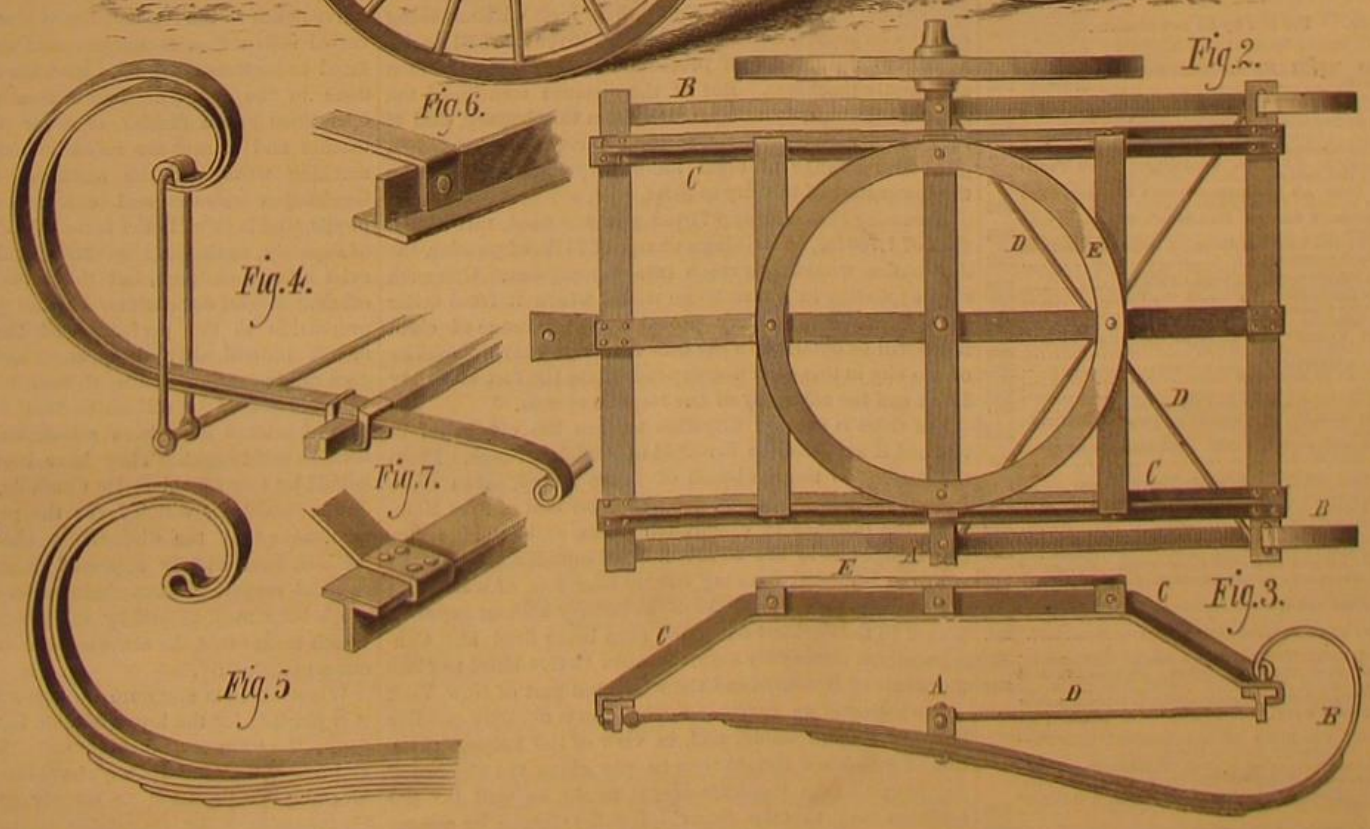


Fig. 1



MURCH'S CHARIOT CAB

The Platts-mouth Bridge.

A fine steel bridge across the Missouri River, about a mile below Platts-mouth, Neb., on the Chicago, Burlington, and Quincy Railroad, was opened for business August 30. The whole length of the work is about three and a half miles, of which more than two miles is in the east approach, one mile is in the west approach, and the permanent steel bridge is just 3,000 feet long. Previous to the formal opening of this imposing structure it was subjected to a crucial test in the presence of a large number of civil engineers and bridge builders from all parts of the country. With a combined weight of eight heavy engines, 450 tons were run on the bridge. The measure showed a deflection of about three inches. This is considered a highly satisfactory test and a less deflection than was expected. The cost is $600,000.

Welding Horn

Pieces of horn may be joined by heating the edges until they are quite soft, and pressing them together until they are cold.

Scientific American.

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NEW YORK, SATURDAY, SEPTEMBER 25, 1880

Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 247,

For the Week ending September 25, 1880.

Price 10 cents. For sale by all newsdealers.

COULD A HOSTILE FLEET BOMBARD NEW YORK?

In these days of modern ordnance, when rifled guns can send missiles weighing nearly a ton to distances never contemplated at the time when most of our harbor defense systems were projected, the question cannot fail to arise: Is New York safe from bombardment by a hostile fleet? England, France, Germany, or Italy, could concentrate a dozen heavy iron clads off Sandy Hook within three weeks of a declaration of war, and as we have absolutely no ships whatever to meet them at sea, we should have to depend upon our coast defenses and torpedoes for protection. Are our defenses sufficient to save our sea-coast cities from bombardment?

In view of the enormous ranges obtained by Herr Krupp with his new rifled breech-loading guns, the question also arises whether New York could not be shelled from the open sea, where the enemy would be far beyond the effective range of our forts. In the first place, how far can shells be thrown? For the purpose of bombarding a city it is unimportant that the aim should be accurate. New York could be terribly injured by any kind of stray firing, irrespective of the enemy's capacity to single out particular buildings as targets. But the Krupp guns have shown an extraordinary accuracy at long ranges. The 3½ and 4½ inch guns have given accurate results as high as 9,057 yards, the lateral deviation at this distance being less than 60 yards. Their extreme range, so far as any records have been made public, has not exceeded 11,000 meters, about 11,900 yards, or 6·8 miles. But it is claimed that the larger guns, from 8 inches to 15·75 inches in calibre, will give a much greater range. During our civil war General Gillmore threw shells from a 300 lb. Parrott gun into Charleston, a distance of eight miles. At the Centennial Exhibition in Philadelphia, Herr Krupp exhibited a 12-inch gun bearing the modest inscription: "Range 15 English miles." Probably it is allowable to stretch the truth at an International Exhibition, and so it is not unreasonable to allow ten miles as the outside limit of this gun's range. But Krupp's latest gun, 15·75 inches caliber, throwing a solid shot of 1,760 lb. weight, may very likely exceed even ten miles. In like manner the famous 100-ton guns furnished to the Italian government by Sir William Armstrong may have a range proportionate to their immense size, in which case 12 miles would not be an extravagant estimate for them.

Now let us examine the chart of the sea coast around New York Bay. There are three channels from the open sea to the Narrows. The main entrance passes close under the guns of an unfinished fort on Sandy Hook. The channel is deep and comparatively constant in depth. The Swash channel is about two miles from the Sandy Hook fort, and, at low tide, its depth will not permit the entrance of a vessel drawing more than 24 feet. The third channel is far distant from the fort, but it has a depth of only 14 feet. Now, while every effort would be made, by using torpedoes and other obstructions, to close the main and Swash channels against an enemy's fleet, it is not impossible that an entrance should be effected. Since torpedoes are available only when covered by heavy fire from guns on shore or on shipboard, the ships could proceed in comparative safety, after passing Sandy Hook, until they approached Forts Hamilton and Wadsworth at the Narrows. The fort at Sandy Hook is only half begun, and it is of old and almost obsolete character, and therefore in the event of a hastily declared war it would not be likely to afford much protection. Hence the probability of a fleet passing has been considered; but it is far different at the Narrows. Without going into the particulars of the armaments of these forts it is sufficient to say that there are no vessels afloat that could approach nearer than one-half of a mile to these forts without being sunk by torpedoes, unless some skillful inventor shall devise a hitherto unthought of protection against these hidden and deadly machines. But at the distance mentioned the ships would be only seven miles from the battery, and if they could maintain their position there, and if they had guns with a range of eight miles, they could easily bring the lower part of the city to grief.

Assuming that a Krupp 71-ton gun was used, throwing a shell of 1,760 lb., containing a charge of 73 lb. of powder, the destruction would soon reach into the millions. One such shell exploding in a warehouse would wreck it from cellar to roof. Since it is very probable that a range of eight miles will be obtained in the near future, the invulnerability of the city in this direction depends upon the fort at Sandy Hook and the efficiency of our torpedo system.

But there is another direction whence the city could be reached if guns can be invented of sufficient range. From the Battery to the sea beach of Long Island, seven miles from the Sandy Hook fort and five miles east of Fort Hamilton, the distance is exactly ten miles, and one mile further brings one to the 25-foot line of soundings. In other words an iron-clad drawing twenty-four feet of water can approach within eleven miles of the Battery without exposing herself to the slightest danger of even being fired at. Consequently it needs only a gun to carry twelve miles to place the whole of Brooklyn and the wealthiest part of New York at the mercy of an enemy. Such a gun is not only possible but extremely probable; and, in view of the helpless position in which we should then be placed, in the absence of any navy to take the offensive, it might be well for our business men to take thought for the future by asking Congress to give them some form of protection in the event of war. It opens the widest field for the inventive genius of this country to exert itself to devise such protection.

SCIENCE TEACHING IN SCHOOLS.

The Report of the Committee on Science Teaching in Schools, signed by Professors E. L. Youmans, A. R. Grote, J. W. Powell, and J. S. Newberry, and read before the American Science Association by Dr. Youmans, is a severe but not unjust arraignment of the unscientific methods by which science is usually mistaught in schools. The chief aim of the committee was to inquire how far the public school system has availed itself of the valuable aid which science offers in the proper cultivation of the minds of the young. The association aims to advance science by the promotion of original investigation, and is naturally interested to know whether the methods of the schools favor or hinder genuine scientific study; whether they foster the early mental tendencies that lead to original thought, or thwart and repress them.

That the latter is generally the case is only too evident; yet in every school the belief is that science is taught, and taught scientifically. The reason why fact does not conform to theory in this matter may be found in the single circumstance that the majority of teachers are untrained or contra-trained for scientific thinking, while the few who could be and would be glad to be scientific in their methods of teaching are prevented by the fixed requirements of the schools as developed on examination day. In the words of the committee, the old idea of a school is a place "where knowledge is got from books by the help of teachers, and our public school system grew up in conformity with this ideal. The early effect of grading was to fix and consolidate irrational methods. The sciences were dissimilated to the old practice, and the science teaching falls short at just the points where it was inevitable that it should fall short. The methods of school teaching and the habits of the teachers had grown rigid under the regime of book studies. As a consequence, the science teaching in the public schools is carried on by instruction. Through books and teachers the pupil is filled up with information in regard to science. Its facts and principles are explained as far as possible, and then left in the memory with the other school acquisitions. He learns the sciences as he learns geography and history. He is not put to any direct mental work upon the subjects of science, or taught to think for himself. As thus treated, the sciences have but little value in education. They fall below other studies as means of mental cultivation. Arithmetic rouses mental reaction. The rational study of language, by analytical and constructive tasks, strengthens the mental processes; but the sciences are passively acquired in their results. This is not scientific education, because there is no practice in the scientific method. Science, as a means of training the faculties, in the various ways to which they are severally adapted, is not taught in the public schools. It is not made the means of cultivating the observing powers, or of stimulating inquiry, or of exercising the judgment in weighing evidence, or of forming original and independent habits of thought. As remarked by Agassiz, the 'pupil studies nature in the school room, and when he goes out of doors cannot find her.' This mode of teaching science, which is by no means confined to the public schools, has been condemned in the most unsparing manner by all eminent men of science as a deception, a fraud, an outrage upon the minds of the young, and an imposture in education."

Futher on the committee justly remark that the failure to gain the benefits of real scientific study seems to have its source deep in the constitution of the public schools. In dealing with masses of children classification became necessary, which gave rise to grading and an elaborate mechanical system. The working of children in lots is a great convenience to the teacher, but it strengthens the method of verbal instruction, recitations, and lesson-giving. It is well fitted to impress the public with the idea that there is much done in the schools. There is a prescribed routine of operations and a display of order that is admired. But teacher and learner are subordinated to the system. It is machine work, and the machines make no allowances. Graduation assumes and enforces a uniformity among pupils that is false to the facts. Wide personal differences of capacity, aptitude, attainment, and opportunity not only exist among children, but they are the prime data of all efficient mental cultivation. In the graded schools, just in proportion to the perfection of the mechanical arrangements, individuality disappears; and with individuality goes originality. Science, if rightly pursued, is the most valuable school of self-instruction. From the beginning men of science have been self-dependent and self-reliant, because self-taught. They have been more hindered than helped by the schools. De Candolle, in his valuable book on the conditions which favor the production of scientific men, says that the discoverers, the masters of scientific method, have chiefly appeared in small towns where educational resources have been scanty, and that they have often been most helped by the poorness of their teaching, which means that the schools were not so perfect as to kill out all originality.

Where there is any cure for this state of things, whether it is possible for the lower schools to teach science scientifically, the committee does not say. The truth is education and schooling are and always have been radically at variance, meaning by education an orderly growth in right mental habits through the reasonable attainment of exact knowledge. In the child world there is no science; and the attempt to cram boys and girls with scientific information—science teaching as commonly understood and practiced—is

necessarily fatal to the habit of scientific thinking. On the other hand, if the teacher is to be simply the guide of pupils in their pursuit of real knowledge, in their scientific exploration of the world that lies next to them in space, and in their scope of intelligence, the public must be content with a plentiful lack on the part of their children of the conventional information by which parents judge of the instruction and education of children. Until parents have a truer idea of what knowledge is most worth there can be little hope of radical improvement in this part of school work.

A CHANCE FOR INVENTORS.—THE $5,000 CAR.

Our readers will remember that a prize of $5,000 was offered last year by the American Humane Association for a cattle car so constructed as to allow cattle to lie down while in transit, and to be fed and watered while in the cars. This to prevent the suffering caused by long standing and the injury and delay incident to unloading and reloading. The president of the association, Mr. Edwin Lee Brown, announces in a circular that the money has been pledged and nearly all of it paid over to the secretary of the association and deposited with trustworthy bankers. All competitors for the prize are required to send their models and plans, with full descriptions, to Mr. Brown, corner Clinton and Jackson streets, Chicago, Ill., before the 1st day of October next. All communications with regard to the prize should also be addressed to Mr. Brown.

The judges appointed are Edwin Lee Brown, Chicago, Ill.; John B. Winslow, Boston, Mass.; A. Kimball, Davenport, Ia.; William Monroe, Brighton, Mass.; E. T. Jeffery, Chicago, Ill.

The judges do not prescribe the size or the internal arrangement of the needed car; but among plans which meet the conditions, that will have the preference which can most readily and cheaply be adapted to the cattle car now in use. Of course, also, that car which can be most easily adapted to the transportation of other live animals and merchandise, if in other respects satisfactory, will have the preference.

It is expected that competitors will take out patents for their inventions, before submitting them, or not, as each shall choose; but the judges must be fully satisfied of the legal title of a claimant to his invention, before awarding to him the prize, or any part of it. The prize winner must also convey to the American Humane Association, or to such persons as its Executive Committee shall designate, a patent for the United States and Canada of the invention, which shall be satisfactory to said committee, before any part of the prize money will be due to him.

As models and plans may be seen by others than the judges while in their possession, they suggest, as a precautionary measure, that each inventor file a caveat at the United States Patent Office before sending them.

The East River Bridge.

The first consignment of steel—27,460 pounds—for the superstructure of the East River Bridge has been received, and rapid deliveries are expected from this time on, the Edgemoor Iron Company having put its full force upon this contract. The guys of the superstructure, manufactured by the Roeblings at Trenton, of Bessemer steel, have also arrived. The Cambria Steel Company, which furnishes the steel, has about a thousand tons ahead of the Edgemoor Company. Colonel Paine reports that the steel has all been tested and is of superior quality, the strength of the steel trusses being six times greater than is likely to be required.

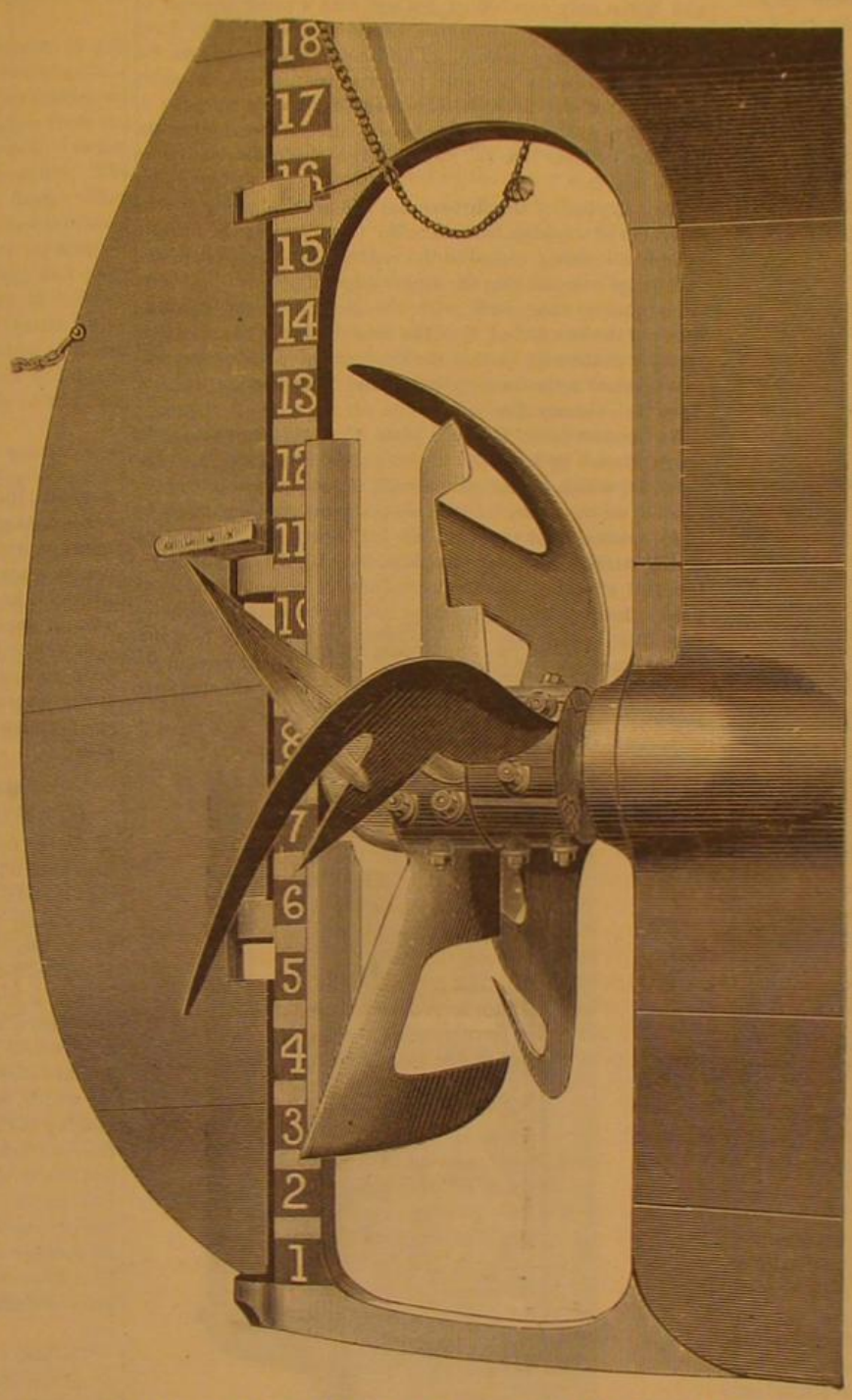
The last structure to be razed to make room for the New York approach will soon be cleared away. Thus far the bridge has cost $14,000,000—of which sum $3,000,000 went under water and $4,000,000 went for real estate, to be covered by a mile of costly masonry. In the profile drawing of the completed structure the lofty towers sink to comparative insignificance. The projection carries in the observer's mind a sense of length rather than of height. The superb arches at Vandewater and Rose and William and North William streets, the massive anchorages at Franklin square in New York and Main street in Brooklyn, and the airy bridge over Pearl street become, says a critical observer, more conspicuous in this picture than are the towers, which are so imposing as seen at midstream on the East River.

It is calculated that with the greatest possible weight on the bridge and in the hottest of August days, with the tide at its highest, there will be 135 feet 6 inches in the clear between the lowest point in the bridge, midstream, and the surface of the East River.

THE production of Bessemer steel rails in the United States in 1869 was 2,550 tons; in 1878, 550,398 tons, and 9,307 tons of open-hearth steel rails in addition.

THE DE BAY PROPELLER.

The De Bay propeller, an English invention, which has attracted much attention since its efficiency was made public by a series of experiments in 1879, has recently been fitted to a steamship of a sufficient size to give a decided test of its value. The Cora Maria, a steamer of 831 tons net register and 2,800 tons displacement, was the vessel used for the experiments. Her dimensions are: Length, 235 feet; breadth, 31 feet; depth, 18 feet 3 inches. Her engines are of the compound inverted cylinder and surface condensing type, the high pressure cylinder being 28 inches, and the low pressure cylinder being 54 inches in diameter, with a stroke of 3 feet. The screw used in the first experiment was an ordinary four-bladed screw, having a diameter of 13 feet 2½ inches, and a pitch of 19 feet 6 inches. With this screw a trial was made over a course of two and one-fifth knots on the 10th of July last, and then the De Bay gearing and propeller (diameter 11 feet) were fitted to the vessel and a trial was made under exactly similar conditions on the 10th of August. The results obtained from each trial are herewith tabulated for comparison, it being understood that in each case four runs over the course were made, the first and third being with the tide and the second and fourth against it.



THE DE BAY PROPELLER.—THE TWO HUBS WITH THEIR BLADES MOVE IN CONTRARY DIRECTIONS.

	Ordinary screw.	De Bay propeller.
Average revolutions per minute	66·32	65
Average steam pressure, pounds	74·7	74·5
Average vacuum, inches	25·58	24·25
Indicated horse power	584·51	585

TIME.

	First course.	Second.	Third.	Fourth.
Ordinary screw	12m. 5s.	20m. 27s.	12m. 3s.	19m. 56s.
De Bay propeller	9m. 4s.	16m. 42s.	9m. 6s.	16m. 10s.

SPEED IN KNOTS PER HOUR.

	First course.	Second.	Third.	Fourth.
Ordinary screw	10·924	6·45	10·954	6·62
De Bay propeller	14·557	7·898	14·505	8·162

TURNING THE CIRCLE.

	Ordinary screw.	De Bay propeller.
To port	4m. 44s.	4m. 33s.
To starboard	6m. 51s.	5m. 4s.

The mean speed obtained on each trial was 8·73 knots for the ordinary screw and 11·28 knots for the De Bay propeller, or an actual gain for the latter of over 29 per cent for the same expenditure of power. Assuming that the resistance varies as the cube of the speed (and practically this ratio is greatly exceeded), since it required 584·51 horse power to drive the Cora Maria at a mean speed of 8·73 knots with the ordinary screw, it would have required 1,256·69 horse power to drive her at the speed of 11·28 knots obtained by the De Bay propeller. We might easily go on to calculate the immense saving in fuel thus obtained, but the foregoing figures are sufficient to call attention to the advantages of the new propeller.

With the ordinary screw there is, as every one knows, a great deal of vibration, and the stern of a screw steamer shakes and quivers very unpleasantly; while the De Bay invention produces no local commotion at all.

Since the first trial in 1879 the shape of the larger half of the propeller blades has been somewhat altered. Formerly they were designed so that they nearly filled up a segment of a circle having the same diameter as the propeller. They now have a curved form in place of an angle, and each blade, instead of a uniformly increasing pitch, has a pitch of 17 feet to half radius, increasing therefrom to a pitch of 19 feet to 21 feet.

The Cora Maria is now on a voyage to Alexandria, Egypt, with a full cargo, and the reports of her captain and engineer will be awaited with great interest.

TRAVELING FLIES.

On the afternoon of Saturday, September 4, the steamboat Martin encountered, on the Hudson River, between New Hamburg and Newburg, a vast cloud of flies. It reached southward from shore to shore as far as the eye could reach, and resembled a great drift of black snow. The insects were flying northward "as thick as snow flakes driven by a strong wind." The steamer Mary Powell ran into the fly storm off Haverstraw, some forty miles below where the Martin encountered it. The flies were "long and black and had light wings."

A dispatch from Halifax, Nova Scotia, states that on Sunday, Sept. 5, immense swarms of flies passed over Guysboro, 120 miles northeastward of Halifax. They came from the east and resembled a dark cloud.

A correspondent of the Toronto *Mail*, writing from East Pictou, Nova Scotia, describes a similar phenomenon as occurring there August 21. The flies, forming a veritable cloud, passed Lismore at 6 o'clock in the evening, close to the shore. They went with the wind, which was blowing lightly from the west, occupying about twenty minutes passing a given point. They made a loud, buzzing noise, which was heard by many who missed seeing them. They flew so low that some of them appeared to fall into the water. About two miles below Lismore they slightly changed their flight, heading more to the north. After their passage numbers of strange flies were observed in some of the houses near the shore. They were about half an inch in length, with wings proportionately longer than those of the common house fly, but whether they belonged to the swarm is uncertain.

In none of these American reports are the flies mentioned as biting, like the swarm of flies which invaded the port of Havre, France, a few weeks ago. From the indefinite descriptions given of them it seems possible that the American flies may have been ichneumon flies, which have had an exceptionally favorable season for multiplication, owing to the multitudes of army worms in which they deposit their eggs.

American Glass Making.

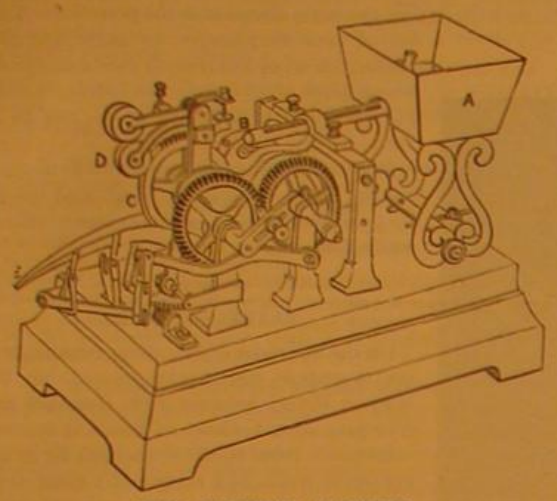
The first glass factory in America was erected in 1609 near Jamestown, Va., and the second followed in the same colony twelve years later. In 1639 some acres of ground were granted to glassmen in Salem, Mass., probably the first year of the industry which was prosecuted there for many years. The first glass factory in Pennsylvania was built near Philadelphia in 1683, under the direction of Wm. Penn, but it did not prove successful. The first glass factory west of the Alleghenies was set up by Albert Gallatin and his associates in 1785, at New Geneva, on the Monongahela River. A small factory was established on the Ohio River, near Pittsburg, in 1790, and another in 1795. The earlier attempt failed, the later was quite successful. In 1810 there were twenty-two glass factories in the country, with an annual product valued at $1,047,000. There are now about five times as many factories, producing eight times as much glass. According to the returns received under the recent census, our flint glass factories turn out 210,554 tons of table and other glassware; and the window-glass works produce 2,644,440 boxes. The total value of the product is nearly $45,750,000.

The Anglo-American Telegraph Company.

This company has lately laid a new cable between Ireland and Newfoundland, and now has four separate cables in operation. By the use of the new duplex system the directors report that they are able to do as much business on these four cables as could formerly have been done on eight cables.

FRENCH PILL PRINTING MACHINE.

The engraving shows a pill printing machine invented by M. Vial, of Paris. The pills, first coated, are placed in the hopper, A, and are conducted thence, one by one, along a small groove to B, where they drop through a cylinder to another groove. At a certain point in their passage they are brought in contact with a wheel, C, which is being turned by the operator. On the outer rim of the wheel the type is fixed, it is inked from little rubber cylinders, D, as it revolves, and the pill meets the wheel just as the type approaches. It receives the impression in beautifully clear characters, and is henceforth unmistakable as to its proper-



PILL PRINTING MACHINE.

ties, no matter in what company it may ultimately find itself.

A Model Foreman.

The following, from the *Manufacturer and Builder*, contains not only good advice to the class of persons to whom it is addressed, and to which they will do well to heed, but to the manufacturer it suggests some of the qualifications a foreman should possess to insure harmony and good feeling among the workmen:

He will not discharge a good workman for a slight offense, and retain the poorest men. A good foreman (instead of giving his order to a man verbally and imperfectly) will always carry a sketch block or pad in his pocket, and where drawings are not used, will give his orders on paper, together with a rough pencil sketch if required. He should then require the workmen to file away those orders, thus putting him in the possession of the necessary evidence to defend himself in case there should be any fault with the work when completed.

A foreman should realize that his workmen are entitled to his respect, and he should conduct himself in such a manner that when he moves about among his men they will feel in duty bound to show him all the courtesy which pertains to his position. His personal habits should be such as may with profit be imitated by every man in the shop. If a workman gets into trouble over a piece of work, a kind and sympathetic foreman will always help such a person out of his difficulty.

It is wise for a foreman to employ only the best language toward his men, for the use of profanity not only creates an enmity between the foreman and the workman, but also destroys the ambition and interest which the latter should always manifest in his work.

A foreman should be systematic, and wherever a standard or a certain routine can be applied to any branch of the work it should be done. Tools, instead of being left scattered over the floor, should each have a particular place. Thus, both the foreman and workman are saved the aggravating annoyance of searching for these tools.

When a piece of work is given to a mechanic he should always be allowed to finish it, for one of the most disagreeable things, and also one of the most humiliating to the workman, is to commence a piece of work and then have the foreman to take it to some one else to finish.

Finally, a model foreman should endeavor to make himself so useful to his employers that they cannot well do without him, taking the same interest in managing the shop and studying economy with as much care as if his own capital were invested in the business. The manufacturing world are looking for artisans of this kind, and any person who has followed the opposite plan will, by adopting the principles herewith outlined, be agreeably surprised in a short time that he can make progress with so much greater satisfaction to himself than ever before.

A Novel Horseshoe.

A Berlin manufacturer is making a horseshoe of iron and hemp that is receiving considerable favor among the Germans. The shoe is of malleable iron carrying a deep wide groove, into which tarred hemp rope is firmly wedged. The rope is so thick that it protrudes beyond the rim of iron. The shoe is very light, and is said to be serviceable.

A Large Ingot of Steel.

There was cast recently at the Norway Iron Works, South Boston, an ingot of steel 10 feet 4 inches long, 24 inches square at one end, and 26 inches square at the other. It weighed 19,000 pounds, exceeding by some 9,000 pounds the largest casting of the sort previously made. The mould, which was of cast iron and weighed 13,700 pounds, was constructed by the Bridgewater Iron Company. The ingot is to form a part of a pumping engine now being made by the Bridgewater Company for the Calumet and Hecla Mining Company.

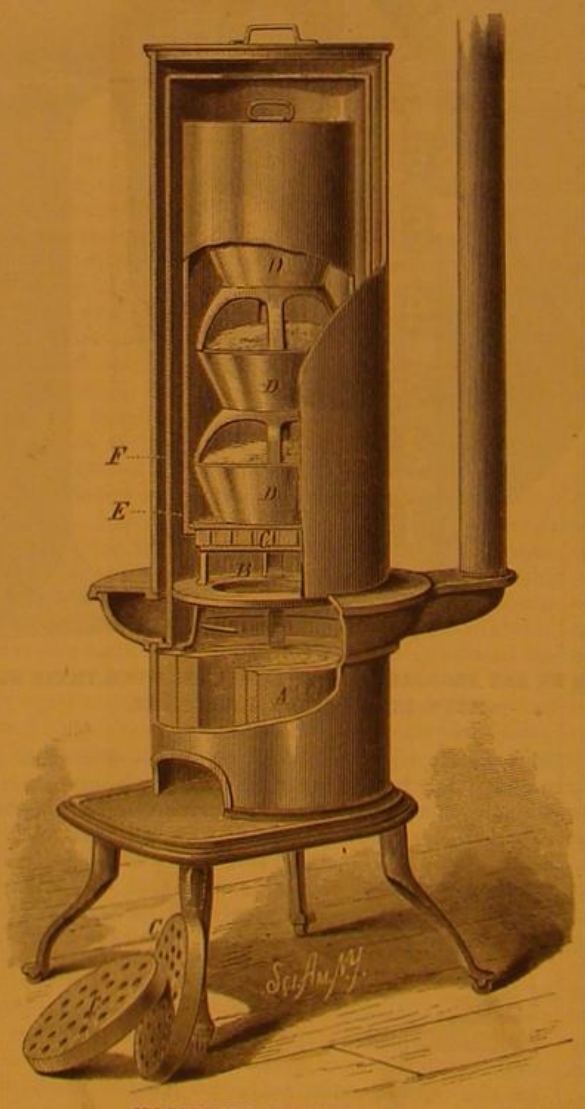
NEW PORTABLE OVEN.

It is generally admitted that for some culinary operations the ordinary cook-stove and range are neither effective nor economical, and it has been determined by actual experiment that in the matter of baking, ordinary stoves are wasteful of both fuel and time.

The new portable oven shown in the engraving is designed to be used in connection with an ordinary portable furnace, and is not only capable of baking with a small amount of fuel, but it also prevents the dissemination of odors from the articles being cooked. The inventor contracts the fire pot of an ordinary portable furnace by inserting an extra lining, A, of fire brick; this serves the double purpose of materially reducing the fire space and of preventing the radiation of heat into the room—a very desirable feature in warm weather.

The top plate of the furnace has the usual opening for the reception of cooking vessels. To this opening is fitted a cylindrical casing, closed at the top by a removable cap, and to a flange surrounding the upper edge of the fire pot is fitted a cylinder concentric with the outer cylinder, forming between the two a flue, F. The inner cylinder has a central opening at the top, so that the products of combustion may pass upward in the inner cylinder, and downward in the flue, F, to the chimney flue.

An annular plate, B, and a plate, C, of refractory material are supported by legs which rest on the fire brick, A. The pans, D, which contain the dough, are supported one above another on the plate, C, the several pans are separated by light frames, and they are all inclosed by a cylindrical casing which rests upon the plate, C. By this arrangement the full effects of the fresh products of combustion is utilized in heating the inner casing and its contents, there being very little loss of heat by radiation, owing to the fact that the products of combustion, which pass upward around the inner casing, descending the flue, F, form an effectual air-jacket which prevents the chilling of the oven.



MACALPIN'S PORTABLE OVEN.

The design of the inventor is to concentrate and make use of all of the heat from the fire, so that none of it shall pass up the chimney and be wasted, and at the same time to have such control of it as to permit more or less of it to escape into the room as may be desired, and to carry off all offensive odors and smoke which commonly escape into the room when cooking is done in the usual way. Either coal or gas may be used as fuel. The oven is made in different sizes, large ones being made for hotels and bakeries.

The oven is raised from the furnace by cords or chains passing over pulleys in the ceiling, with counterbalance weights at the end.

These ovens may be adapted to broiling, frying, or cake making. We are informed by the inventor that a loaf of bread weighing two pounds two ounces has been baked in one of these ovens in thirty-two minutes, and that eight and a half pounds of bread can be baked in the same length of time.

This invention was recently patented by Mr. Daniel MacAlpin, 2041 Ridge avenue, Philadelphia, Pa., who should be addressed for further information.

HENS' WIRE NESTS.

It is a well known fact that straw or hay nests or basket nets for setting hens cannot be kept free of vermin. The

IMPROVED HEN'S NEST.

annexed, illustration, which we take from the *Leipziger Illustrirte Zeitung*, shows a very practical and simple nest. It is made of wire netting, and is filled with hay or straw, which can be removed and replaced with fresh material very conveniently. As the air can circulate through the nest quite freely vermin are not apt to infest the nest. It is also stated that it is well to pour petroluum on the bars or rods of a chicken coop so that the petroleum will spread on the feet of the fowls, so that when they scratch themselves they will bring the petroleum in contact with the body, dispersing the vermin.

Railway Ties and Telegraph Poles.

But few people comparatively have any idea of the amount of timber used in the construction of a single railroad. We hear that our forests are rapidly disappearing, and we know that material for building and fuel causes the sacrifice of many leafy monarchs of the forest; yet only the initiated knows that it yearly takes 200,000 acres of forests to supply cross-ties for the railroads of the United States. We interviewed a gentleman who has been in the business for thirteen years, and concluding that his observations and experience would be of interest, we give the substance of his talk: It takes 15,000,000 ties to supply the demand on our railroads, for which, on an average, the contractors get 35 cents apiece, making in the aggregate $5,250,000. In building a new road the contractors figure on 2,700 ties to the mile, while it takes 300 ties to the mile to keep a constructed road in repair. Contractors, of course, buy pieces of timber land as near to the proposed line of road as possible, paying for the timber an average of $20 per acre, or giving the proprietor of the land 10 cents for every tie got out. The average of a good piece of timber land is 200 trees to the acre and 12 ties to the tree.

The size of a cross-tie differs on different roads, but the usual size demanded is 8 feet 6 inches long and 8 inches face. White or burr oak is considered the best timber for the purpose, although cherry, maple, ash, and even locust have been used. The last named were first used on the Little Miami Railroad, and after a time thrown aside as unfit for the purpose. Railroad men much prefer ties hewn out with an ax to those sawed in a mill, and many contend that the first named will considerably outlast the sawed ties. This theory is probably a fallacy, as sawed ties have been placed alongside of hewn ties, and remained sound twice as long. This business gives employment to an army of choppers, who are paid 10 cents apiece for each tie. A continued practice makes the choppers expert in the use of the ax, and a single man has been known to get out 35 ties in a day; yet the average is only 10, while an expert will probably get out 20. During the war, when ties sold at from 50 to 65 cents, choppers were paid 12½ cents apiece. Although the contractor gets 35 cents apiece from the railroads for each tie, still there is a loss of from 5 to 7 per cent on dockage and stealage. An inspector is sent by the company to inspect the ties. This is generally a clerk from some of the offices, who frequently knows but little as regards the strength or durability of timber, and, as a consequence, some of the best ties are docked and only bring 20 cents apiece. The stealage is where the section men put in new ties which have not been inspected and received, and fail to report the use of the same to the roadmaster.

Most all cross-tie men also contract for bridge timbers and trestling, as well as telegraph poles. For the latter chestnut and cedar are mostly used. They bring about $1.75 apiece, and are cut mostly in the tamarac swamps of Michigan and the forests of Southern Kentucky and Tennessee. Large sums of money have been made by lucky contractors above

described, and each only adds to increased demands. Ohio has over 4,000,000 acres wood land, yet the ever-increasing demand for railroad purposes alone, if supplied entirely from our forests, would leave us without a single stick to mark the existence of our once dense forests.—*Cincinnati Commercial.*

Adulterations of Carpet Yarns.

The use of cow hair, buffalo hair, camel's hair, and Russia cattle hair for the adulteration of wool is becoming a recognized business. It is claimed that these hairs are excellent substitutes for wool, and not only cheaper, but fully as durable.

We have records of its use at different eras in the world's industrial record, but as frequently as it has been employed so frequently has it been relegated again to the qualification of mattress and sofa stuffings. For some years, however, it has been employed by many carpet manufacturers to be worked into the yarns.

It is gathered in large quantities, and brought to this market for use in carpets at the rate of fully twenty million pounds per year. How much is made up in other fabrics we are unable to state. The hair is invariably taken from the hide at the tanner's, by means of a process termed "sweating," and is not clipped, as is the popular supposition. The hides are soaked in vats for from three to five days. They are then stretched on beams or stands, with arched surfaces, thus, ⌒, and then rubbed with a *scicer*, or scraper. The hair is easily susceptible to this proceeding, and peels off. It is next washed and baled. The hair is brought mostly from the West, though considerable "cattle hair" (called Russian cattle hair) comes from Europe. About four million pounds are imported to New York and Philadelphia annually, and used in the manufacture of blankets, cloakings, and carpets.

Buffalo hair is also used, though there is not so much coming into the market now as formerly, owing to the law having prohibited the slaughter of the animal for fear of the utter extermination of its breed. Two million pounds will cover the amount worked into carpets per annum. And again we find camel's hair used. We conversed with one dealer recently who assured us that he had sold over four hundred thousand pounds of the stuff during the past four months. This, like all such matter, is incorporated with other material—wool, shoddy, etc.—before spun into yarn.

Of the various hairs incorporated with wool textures, cow hair is the most common. When received in its rough state from the West, in bales, it is, *first*, washed; *second*, put through a picker, which eradicates all impurities; *third*, it is spread on an "apron," in quantities according to the intentions of the manufacturer, and the proportions of wool and shoddy are likewise selected and mixed with the hair; *fourth*, from the apron, the hair, shoddy, and wool are worked off (by a tender—usually a young girl—who mixes the selections) on to a carding machine, which mixes the properties evenly. It is then spun. The same process is applicable to all other kinds of hair.

The red cow hair is sold for about two and one-half to three and one-half cents per pound, and refuse light colorings; the *white* brings from eight to twelve cents per pound.

The Russia cattle hair costs more, the prices for which are: Russia cattle hair (red), four cents; Russia cattle hair (white), twelve cents. This hair, which was sent here at one time in no inconsiderable quantities, is now imported more cautiously. Much of the material was formerly lost in the refuse of the waste troughs and imperfected preparatory machines. Now, however, considerable economy is exercised in saving the wash and utilizing it. The prices brought to day, in the New York markets, for these "mixings" for *woolen* yarns, are as follows:

Cow hair (red), 2½ to 3½ cts.; cow hair (white), 8 to 12 cts.; buffalo hair, 8 to 12 cts.; camel's hair (Russian), 16 to 20 cts.; camel's hair (China), 22 to 28 cts.; camel's hair (noils), 40 cts.; Russia cattle hair (red), 4 cts.; Russia cattle hair (white), 12 cts.—*Carpet Trade Review.*

Tincture of Insect Powder.

A concentrated tincture of insect powder is highly recommended as an insecticide by Finzelberg, who prepares it by digesting one part of Persian insect powder in ten parts absolute alcohol, and claims that in order to prove efficacious it should be scattered by means of an ordinary perfumery atomizer. When thus used in closed rooms all flies soon drop dead; while scattering it over linen, etc., acts as a protection agains fleas, etc.

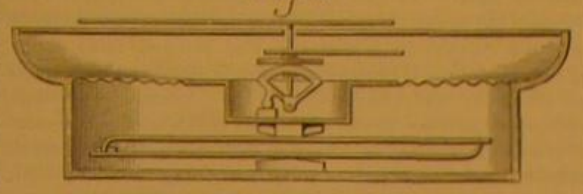
Azotine.

The *Annales Industrielles* notes a new discovery by M. Heddebault, which consists in the separation of wool from cotton in rags and waste products in which these two textiles are mixed, by treating them with steam at 150° C. under a pressure of five atmospheres. Under the influence of this temperature the wool is decomposed, fuses, and flows off into a lower receptacle, while the cotton, flax, and in fact all vegetable fiber, are unattacked. It is then only necessary to pound and wash the latter to obtain products containing no longer any traces of wool, and which are admirably adapted for bleaching and manufacturing into paper. The solution of wool, evaporated to dryness, has been named by the inventor *azotine*. Owing to the increase in value of mixed cotton and woolen rags thus treated, especially for paper making, the cost of the operation is virtually covered, and the new product—*azotine*—costs really nothing. This material, which is completely soluble in water, and which contains all its nitrogen in a soluble form, is to be used, mixed with dried blood, as a fertilizer. The invention is said to be an important one, both for the paper making industry and for agriculture.

THE FIRST INVENTOR OF THE STEAM GAUGE.

Mr. Sydney Smith, of Nottingham, England, who claims to be the "original inventor and first patentee of the steam pressure gauge," not long since sent a letter to the *Engineer* setting forth his claim, and giving a copy of a corroborative

Fig. 2



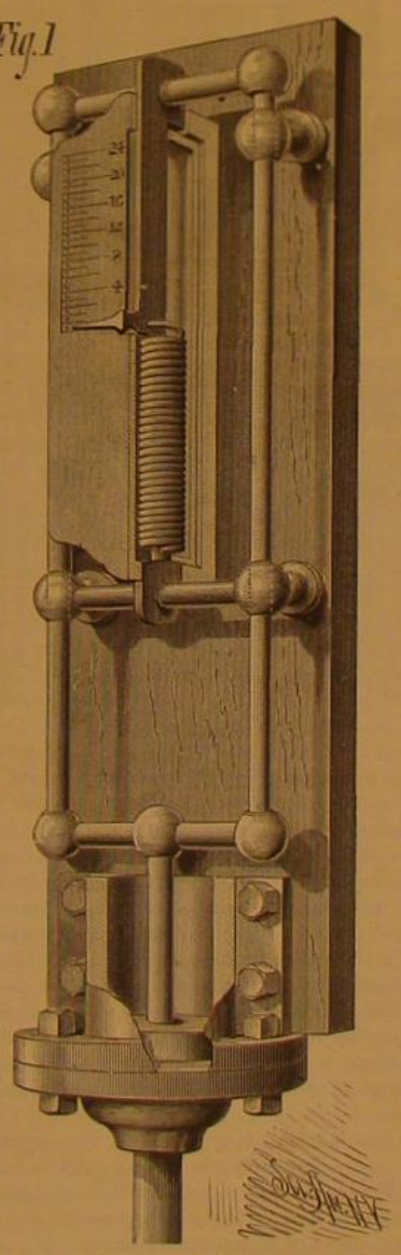
MOREAU'S STEAM GAUGE.

letter from George Stephenson. The following is the letter, together with a note appended by the editor of the *Engineer:*

"Tapton House,
"Chesterfield, October 15th, 1847.

"A most important invention has been submitted to me for my approval, patented by a Mr. Smith, of Nottingham, and intended to indicate the strength of steam in steam engine boilers. It is particularly adapted for steamboats, and can be placed in the cabin, on deck, or any other part of the vessel, where it may be seen by every passenger on board. It may also be fixed in the office of every manufactory where a steam engine is used at a considerable distance from the boiler. I am so much pleased with it that I have put one up at one of my own collieries. It is some distance from the boiler—in another house—and works most beautifully, showing the rise and fall of the steam in the most delicate manner. The indicator is like the face of a clock, with a pointer,

Fig. 1



BRADLEY'S STEAM GAUGE.

making one revolution in measuring from 1 lb. to 100 lb. upon the square inch of the pressure of steam. It is quite from under the control of the engineer, or any other person, so that its indications may be relied upon, and the construction is so simple that it is scarcely possible for it to get out of order. I might give a full explanation of the machine, but I think it best to leave that to the inventor himself. The numerous and appalling accidents which have occurred from the bursting of steamboat boilers have induced me to give you these observations, which I think desirable to be laid before the public. I may state that I have no pecuniary interest in the scheme, but being the first person to whom it has been shown, and the first person to make use of it, I feel it a duty I owe to the inventor, as well as the public, to make it as universally known as possible. The indicator is put up at Tapton Colliery, near Chesterfield, and may be seen any day by any respectable person.

(Signed) "GEORGE STEPHENSON."

"[We have taken some trouble to investigate Mr. Smith's claim to be considered the first inventor of a practical steam gauge, and we have every reason to believe that he is entitled to that honor. In other words, Mr. Sydney Smith, of Nottingham, patented, in 1847, the first steam gauge which was efficient, compact, portable, and suitable for use on boilers carrying a high pressure of steam. We have failed to find any record of an invention fulfilling the same objects of older date than Smith's patent.—ED. *E.*]"

We have been more fortunate than the editor of the *Engineer* in our search for the anticipator of this invention, in finding that two patents were granted in this country for practical steam gauges prior to 1847.

The first was granted to George Bradley, of Paterson, N. J., August 16, 1841. The second to De Fontaine Moreau, of London, England, August 20, 1846.

The construction of Bradley's steam gauge is so clearly shown in Fig. 1 as scarcely to require description. It consists of a cylinder connected with the boiler and containing a piston which is acted on by steam pressure, and connected with a rectangular sliding frame whose upward movement is opposed by a spiral spring. The sliding frame carries a pointer which moves over a fixed scale. Of this steam gauge the inventor, in his patent specification, says:

"The operation of the machine is thus: The steam pressing against the piston forces it outwards or towards the spring, and with it the rectangular frame, the cross-head of which, being connected with the fixed bar, causes the spring to which it is attached to become elongated, and the index which it carries to move opposite to that part of the scale which indicates the pressure against the piston. When the ordinary spring balance is used, if the area of the piston is one inch, the index will point on the scale to the number of pounds per square inch of pressure in the boiler above that of the atmosphere; the scale, however, admits of any mode of graduation.

"This machine is expected to become a necessary appendage to every steam boiler, for the purpose of enabling any one, however ignorant, to tell at any time by sight the pressure of steam in the boiler as well as the most experienced engineer.

"It is believed that there is now no instrument in use for this purpose. The ordinary spring balance which is usually attached to locomotive engines is connected to the lever of a safety valve, and merely indicates the pressure of the steam at the instant it is capable of lifting the valve and at no other time, and even then it requires a nice calculation to ascertain the pressure on the boiler, as it depends on the leverage of the safety bar, so that to an ordinary traveler it affords no information of the pressure of the steam by looking at it however minutely, while by the one now proposed, literally, 'he who runs may read,' and when we reflect on the number of lives that have been lost on board steamboats which such an instrument might have been the means of preventing, its value as a life-preserver will be apparent to all."

In Moreau's steam gauge, shown in the smaller engraving, the steam pressure acts on a diaphragm, whose motion is multiplied by a toothed quadrant and a pinion on the index arbor.

Nevada's Natural Phenomena.

Nevada is a land of curious natural phenomena. Her rivers have no visible outlet to the ocean. She has no lakes of any magnitude. She has vast stretches of alkali deserts, however, that give every indication of having been the beds or bottoms of either seas or lakes. Down in Lincoln county there is a spring of ice-cold water that bubbles up over a rock and disappears on the other side, and no one has been able to find where the water goes. At another point in the same county is a large spring, about twenty feet square, that is apparently only some eighteen or twenty inches in depth, with a sandy bottom. The sand can be plainly seen, but on looking closer it is perceived that this sand is in a perpetual state of unrest. No bottom has ever been found to this spring. It is said that a teamster, on reaching this spring one day, deceived by its apparent shallowness, concluded to soak one of his wagon wheels to cure the looseness of its tire. He therefore took it off and rolled it into the, as he thought, shallow water. He never laid his eyes on that wagon wheel again. Our mountains are full of caves and caverns, many of which have been explored to a great distance. Speaking of caves, a redeo was held last spring over in Huntington valley. During its progress quite a number of cattle were missed and for a time unavailing search was made for them. At last they were traced to the mouth of a natural tunnel or cave in the mountain. The herders entered the cave, and following it for a long distance, at last found the cattle. It appears that they had probably entered the cave, which was very narrow, in search of water. It had finally narrowed so that they could proceed no further. Neither could they turn around to get out. They had been missed some days, and if they had not been found must inevitably have perished in a short time. As it was they were extracted from their predicament with difficulty, by the herders squeezing past and getting in front of them and scaring them into a retrograde movement by flapping their hats into the faces of the stupid bovines.—*Eureka Leader.*

Another New Atlantic Cable.

When the excitement in this country and Europe which attended the laying of the first Atlantic cable, and the doubt, delays, and misfortunes of that great enterprise, are contrasted with similar operations at the present time, we are enabled to realize the progress which has been made in telegraphy within less than a quarter of a century. The Anglo-American Telegraph Company has just completed the work of laying a new cable from Valentia to Heart's Content, and so much a matter of course has it become, and so certain and comparatively easy an operation, that it attracts scarcely any public attention. The newspapers record the fact in a news paragraph of a dozen lines, and scarcely an allusion is made to it in editorial columns.

These slender cords buried in the depth of the sea now connect every country of the earth, and the history of the preceding day at the Antipodes appears in the morning papers as regularly as the incidents occurring in the immediate vicinity of their publication. The electric telegraph has bound together the most widely separated sections of the earth, and has revolutionized the business and social systems of the world.

The Atlantic cable telegraph business has developed so enormously and is so rapidly and constantly increasing as to continually demand additional facilities, and these the Anglo-American Company promptly furnish. A few years ago one cable more than sufficed for all the business offered. The business was then an experiment, and the necessarily high rates charged for the service restricted the patronage to very limited proportions. From time to time, as experience enabled it to be done with safety, these charges have been reduced until, at the present time, messages are transmitted between this country and Europe at rates which would have speedily ruined any company a few years ago. It is true that the charges for cable telegraph service across the Atlantic are at present abnormally low (12½ cents per word) in consequence of bitter competition of rival companies, but even without such competition the service will hereafter be profitably performed at a cost to the public which, not many years since, would have been regarded as absurd and ridiculous to propose. This is made possible by improvements in the construction and operation of the cables. By duplexing the cables their capacity for the transmission of business has been practically doubled, and it is not regarded as impossible that their capacity may yet be still further largely developed.

The Anglo-American Company has now in operation four cables, and the Direct United States one, which by the successful application of the duplex system in working them afford facilities equal to what would have been realized with ten worked in the ordinary way. It is expected that these will adequately meet the demands of the public for some time to come. Should more be required, however, the managers of the Anglo-American and Direct Companies are prepared to supply them promptly, each company having wisely accumulated a large reserve fund for maintenance of existing cables, and providing new ones as required.

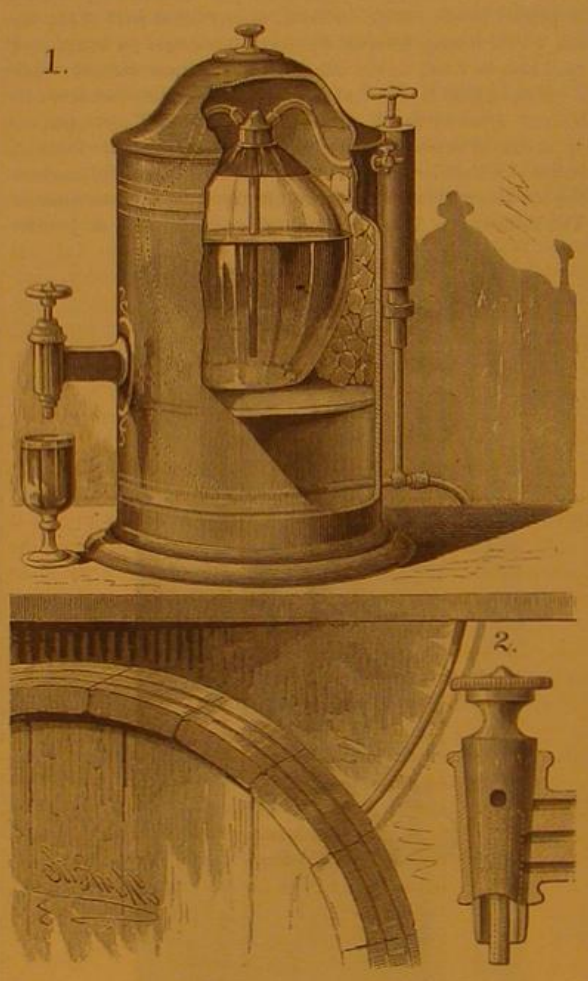
The efforts of the cable companies are liberally seconded by the Western Union Company, which is now engaged in building an entirely new line of the largest wire used for telegraphic purposes, which is to be quadruplexed and used exclusively for cable business.—*Journal of the Telegraph.*

A Chemical Lung.

On Wednesday, August 18, Dr. Richard Neale, in the presence of a number of engineers, including the manager of the underground railway, and other scientific men, gave an interesting and, as far as it went, successful demonstration of a scheme to purify the foul air of tunnels, mines, cabins, churches, theaters, hospitals, and other buildings. The proposal is, we believe, a novel one, and promises to create a new era in ventilation. Nearly all attempts hitherto made to purify the air in crowded buildings have been mechanical, and have consisted of driving out the foul air by currents of fresh air. Dr. Neale's proposal, on the other hand, is a chemical one, and is designed to destroy the poisonous gases. It is not, of course, intended to supersede ordinary ventilation by currents, but rather to act as an auxiliary. The essence of the scheme is the adoption of some simple chemical facts. As the lungs of living beings appropriate oxygen and give off carbonic acid gas, Dr. Neale proposes to make a "chemical lung" which will appropriate carbonic acid and sulphurous gases from the air containing them, without yielding any products in exchange. The air in the tunnels of the underground railway was referred to as a conspicuous and well known example of impurity irremediable by mechanical means. The principal deleterious gases in this instance are carbonic acid and sulphurous gases and carbonic oxide. All these, but especially the two former, may, Dr. Neale maintains, be easily got rid of by chemical means. By mixing a solution of sulphurous acid and water in a flask Dr. Neale made an excellent imitation of the air at the Baker street or Portland road station. He then added a small quantity of solution of caustic soda, and agitated the flask briskly for a few seconds, and immediately the sulphurous smell was abolished. Into the same flask a current of carbonic acid gas was next passed, so that a lighted taper introduced into the flask was at once extinguished. After a few shakings a lighted taper was again introduced and burnt with a bright, steady flame, showing that the soda had taken up the acid. Similar experiments were made with solutions of caustic lime. Dr. Neale said the facts illustrated in these simple experiments formed the basis of his scheme for purifying ordinarily impure air. As regards the Metropolitan and other underground railways, the locomotive engines might, he said, be supplied with a tank containing a strong solution of caustic soda or lime, through which the smoke should be made to pass before being discharged into the outer air. By this means the carbonic acid gas and the sulphur would be eliminated. The carbonic oxide would require to be dealt with in another way, which need not now be explained. In order to attain further purification of the air in the tunnel, each train might be furnished with a truck open at both ends, and appropriately fitted with trays or other contrivances for holding solutions of lime or soda. As the train progressed air would rush through the tanks or trays, and be robbed of its carbonic acid and sulphur in its course. The proposal is as happy as it is ingenious. It further commends itself on the grounds of simplicity and cheapness. It only remains for those concerned, and we would especially indicate the directors of the underground railway and the managers of theaters, to manifest a proper public spirit, and fairly test its practicability. There should be no insuperable difficulty in putting it to a practical test. Meanwhile, we shall watch with interest any attempts that may be made to carry out the idea in detail.—*London Lancet.*

NEW BEER FAUCET.

Beer making and selling have attained an importance both in extent and pecuniary interest all over the world that ranks it among the greatest industries of the age. Malt liquors constitute the beverage of the multitude, and it is essential that these liquors be dealt out in a sweet and wholesome condition. All kinds of malt liquors that are beginning to sour, or have become sharp pricked or stale, are unwholesome, since these terms express the several stages through which all malt liquors pass by exposure to the atmosphere, from a palatable article to that of an offensive and dangerous one; hence various and often expensive devices have been resorted to, both to force beer from a cask without permitting its gas to escape, and to bring it from below up to a counter, none of which have hitherto answered a satisfactory purpose.



NEW BEER FAUCET.

The improved beer faucet shown in the engraving is secured by three United States patents, and is patented in England, France, and Germany. Beer and other malt liquors, to be wholesome and properly preserved, must either contain or be capable of generating an amount of gas sufficient to empty the cask by its expansive force. Proceeding upon this proposition, which was found by numerous trials to be correct, it seemed manifest that to preserve such liquor from becoming stale and unwholesome it was only necessary to prevent the air from entering the cask and the gas from escaping from it, and apparatus, by which a glass of beer can be readily drawn from a fresh keg without waiting for the excess of froth to subside, is desirable.

The patentees of the faucet illustrated claim that they have succeeded in making such an apparatus, which, if adopted, would afford a great pecuniary benefit to the brewer in saving great numbers of long brass faucets, short and less expensive ones being as good, and largely avoiding the liability of empty beer kegs becoming sour and musty by exposure to the air before they are refilled; and it will secure to the retailer a great saving of time, and also the labor attendant upon the insertion and removal of vent valves, to say nothing of the great waste from the beer becoming stale.

This device may be either cheap or ornamental, and it is capable of preventing beer from becoming stale at any age, and it will bring beer that is fit to drink from the cellar without the use of a pump. It will also cool it without extra expense, since the ice that is used to cool drinking water also cools the beer. It can be readily applied to any faucet in a cask by means of a hose and coupling.

The engraving shows a sealed beer receptacle placed in the ice chamber of an ordinary water cooler. The faucet of the cooler, however, performs three separate functions: it will draw ice water from the cooler, it will take beer directly from the cask, or from the glass receptacle, as may be desired. The internal construction of the faucet is shown in Fig. 2. A model of this apparatus is on exhibition at the Inventors' Institute, No. 733 Broadway, New York.

Further information may be obtained by addressing Dr. A. J. Spencer, No. 115 W. 126th street, New York, or the Inventors' Institute as above.

THE AMERICAN SCIENCE ASSOCIATION.

The proceedings of the first two days of the Boston meeting of the American Association for the Advancement of Science were noticed last week. The early promise of a large and, in the fullest sense of the word, popular meeting was amply fulfilled. Nearly a thousand members were registered; 595 new members and 45 fellows were elected, among them Mrs. E. A. Smith, of Jersey City, the first lady thus honored. The number of papers entered was 280. A very active interest was manifested in the proceedings throughout, and the hospitality of the people of Boston and the surrounding towns was unbounded. Boston and its vicinity are rich in institutions, manufactories, pleasure resorts, and points of historic interest, and not a few of the members found these sources of pleasure and profit unsurpassed even by the regular proceedings of the association.

Comparatively few papers were read before the general sessions, the attendance being so large and the number of papers so great that most of the work was done in the sections and subsections. In view of the increasing size of the annual gatherings the committee on membership reported in favor of extending the scope of the association, recommending that instead of two sections with subsections, as at present, the association should have eight, as follows:

A—Physics. B—Astronomy and Pure Mathematics. C—Chemistry, including its applications to agriculture and the arts. D—Mechanical Science. E—Geology and Geography. F—Biology. G—Anthropology. H—Economic Science and Statistics. It was also recommended that there may be a permanent subsection of microscopy, which shall elect its own officers, and be responsible directly to the Standing Committee, and that the Sectional Committee of any section may, at its pleasure, form one or more temporary subsections, and may designate the officer thereof. The report will be acted upon at the next meeting.

Among the other reports of special committees two were of general interest. The report of the Committee on Science-teaching in the Public Schools has been noticed elsewhere. The committee to memorialize Congress and State legislatures regarding the cultivation of timber and the preservation of forests recommended a law to protect trees planted along highways, and to encourage such planting by deductions from highway taxes; also the passage of a law that shall exempt from taxation the increased value of land arising from the planting of trees where none were growing to such period as may appear proper, or until some profit may be realized from plantations; by appropriations of money to agricultural and horticultural societies, to be applied as premiums for tree-planting, and for prizes for the best essays and reports upon subjects of practical forest culture; by encouraging educational institutions to introduce courses of instruction having reference to practical sylviculture; by laws tending to prevent forest fires; by imposing penalties against willful or careless setting of such fires, and enlarging and defining the powers of local officers in calling for assistance and in adopting measures for suppressing them; by establishing under favorable circumstances model plantations; by the appointment of a Commission of Forestry under State authority analogous to the Commission of Fisheries.

The cable message to the British Association, previously referred to, received a cordial answer returning thanks therefor. A message of congratulation was also sent to the venerable M. de Chevreul, senior member of the French Academy, on his 95th birthday.

The officers elected for the next meeting, in Cincinnati, to begin August 17, 1881, are: President, Professor G. J. Brush, of New Haven; Secretary, Professor C. V. Riley, of Washington; Treasurer, Professor W. S. Vaux, of Philadelphia; President of Section A, Professor A. M. Mayer, of Hoboken; Secretary, Professor John Trowbridge, of Cambridge; Vice-President of Section B, Dr. George Englemann, of St. Louis; Secretary, Professor William Saunders, of Canada; Auditing Committee, Professor Henry Wheatland, of Salem, and Professor Thomas Meehan, of Philadelphia.

In the permanent subsection of Chemistry, Professor William Ripley Nichols, of Boston, was elected Vice-President, and Professor H. W. Wiley, of Lafayette, Ind., Secretary. In the permanent subsection of Anthropology, Colonel Derrick Mallory, of Washington, was elected Vice-President,

and Judge J. G. Henderson, of Winchester, Ill., Secretary. A resolution providing for a social reunion of the sections on the second evening of future meetings was adopted.

As already remarked, the most of the papers were read in the several sections and subsections. It would not be possible within the scope of this article even to mention them all by title. A few of those of most general interest may be noticed. In Section A (Physics) Professor A. M. Mayer described the construction and use of the topophone, with which our readers are already familiar. Professor A. Graham Bell presented his new invention, the photophone, the nature and use of which was described last week. Mr. A. P. Dudley, of this city, read a practical paper on "Transportation Expenses and their Reduction," and gave the results obtained by his invention, the dynograph, designed to test questions in regard to the economical handling of railway trains. This instrument shows that on ordinary roads it is more economical in fuel to run freight trains from eighteen to twenty miles per hour than at ten or twelve. It shows the largest types of engines to be most economical, hauling greater loads per pound of coal, reducing the ratio of train expenses per ton carried. Also, that the dead weight per car, per ton capacity of freight, should be reduced to the lowest limit consistent with safety, as it costs proportionately more to haul empty cars than loaded ones.

Mr. Wm. H. Ballou, of Chicago, read a paper on the "Mississippi River Improvement System." A hint of the magnitude of the problems involved was given in the shifting of the course of the Mississippi at Cairo, Ill., a mile in one year. Still more remarkable than this are the operations of the Missouri River. At one time Council Bluffs enjoyed its presence in immediate proximity to the city and the benefits of its commerce, in consequence of which the city became the terminus for the Western railways in preference to Omaha, three times its size. These railroads erected depots and stationed the offices of the general Western superintendents here. The Union Pacific road constructed an immense bridge here, and in common with other railways built a union depot at Council Bluffs. No sooner had this work been completed than the Missouri performed the unexpected feat of moving its channel over to Omaha, three miles away.

Mr. E. B. Elliott, of Washington, read a paper on "Electric Lighting as applied to Large Areas;" Mr. C. J. H. Woodbury one on "Friction and Lubricating Oils;" Professor B. F. Hedrick, of Washington, on "Patent Laws as a Means for the Advancement of Science." Of scientific papers less obviously bearing upon practical affairs the number was large—too large for their reviewing here.

In the subsection of Chemistry a valuable paper on "Laws Governing the Decomposition of Equivalent Solutions of Iodides under the Influence of Actinism" was submitted by Professor A. L. Leeds, of the Stevens Institute. Professor A. A. Breneman, of Cornell University, exhibited samples of common stoneware, hitherto decorated only in blue, on which he has been able to obtain a wide range of colors. On one specimen vase a vine in green was painted upon the ordinary gray body of stoneware. This cheap ware may in this way be made the basis of a new process of underglaze decoration in which the entire piece—color, glaze, and body—is completed at a single burning. The theory of the new process rests upon the thickness and comparative impressibility of the glaze. A note on "Water Analysis" was read by the same gentleman.

Mr. H. W. Wiley, of Lafayette, Ind., read a practical paper on the "Manufacture of Glucose." Professor S. B. Sharples showed a method of testing sugar and molasses; Mr. E. T. Cox discussed the "Oxide of Antimony found in Extensive Lodes in Sonora, Mexico;" J. C. Kleinschmidt read a paper on "Foreign Substances in Iron;" and Professor T. Sterry Hunt one on the "Genesis of Certain Iron Ores."

Section B (Natural History) gave evidence of great activity in this field of science. The subject of "Biological Development in the Animal Kingdom, as Manifested in the Paleontological and Embryological Study of Sea Urchins," was illustrated at great length by Professor Alexander Agassiz; and Professor A. Hyatt found a practical illustration of the "Theory of Evolution in the Transformation of the Planorbis." Incomplete adaptation, as illustrated by the "History of Sex in Plants," was treated by Mr. L. F. Ward; and the "Evolution of Parasitic Plants," by Mr. Thomas Meehan. Dr. S. V. Clevinger submitted a less popular communication on the "Plan of the Cerebro-spinal Nervous System." The "Economic Aspects of Natural History" were touched upon by Professor T. J. Burrill, of the Illinois Industrial University, in a paper on the microscopic cause of "fire blight" in pear trees and "twig blight" in apple trees. Also by Professor Riley in a paper on the "Cotton Worm;" and by Mr. A. J. Cook, who described two new methods of fighting injurious insects. The papers in the subsection of Microscopy were chiefly such as were of interest solely to the specialists of that department.

The papers in the subsection of Anthropology were many and rich in curious information. The "Ethnology of Africa" was discussed by Professor A. S. Bickman. The Myths, Folklore, Language, and Games of the Iroquois Indians, were learnedly discussed by the only lady fellow, Mrs. E. A. Smith. Colonel H. B. Carrington read an interesting paper on the "Dakota Tribes." Judge Henderson described the textile fabrics of the ancient inhabitants of the Mississippi Valley. In explaining the textile art among the mound-builders and other ancient American aborigines, he showed that the modern Indians and these ancient people are bound together by a similarity in instruments and processes of spinning and weaving. The material used was the bush of various trees, nettle, and the hair of the bear, buffalo, deer, and dog. In working up vegetable substances, the bark was first macerated, and, after being dried, it was spun in a multitude of ways. The rudest process was rolling on the thigh. The next improvement was a rude spindle, which passed through various processes of evolution to the modern spinning wheel. The gradations of elaboration through which the loom has passed were illustrated by a series of drawings, collections of raw materials, and models of spindles and looms.

Mr. William McAdams described the agricultural implements of stone anciently employed by the natives of the same region, and Mr. F. W. Putnam spoke of the conventional ornamentation of ancient American pottery. In a paper on ancient quarries of Oriental alabaster and flint in the West, Rev. H. C. Hovey described and illustrated by maps, diagrams, and specimens, some remarkable discoveries made by him in Wyandotte Cave, Indiana. Professor E. S. Morse gave an instructive account of his investigations among the shell heaps and caverns of Japan.

In the subsection of Geology Mr. N. H. Winchel read a paper on "Capriferous Series in Minnesota," and Alexis A. Julien gave a description of the excavation of the upper basin and clove of the Kaaterskill (Catskill) Mountains. L. W. Bailey reported the progress of the geological investigations in New Brunswick in 1879 and 1880, and was followed by H. C. Lewis, upon the "Tertiary Age of Iron Ores of the Lower Silurian Limestone Valleys." Professor Silliman spoke upon the turquoise localities of Las Cenillos. Other contributions to this subsection were: "Granites in the White Mountain Notch upon Mount Willard and their Contact Phenomena," by George W. Hawes; "Eruptive Rocks of Mount Ascutney," by Professor C. H. Hitchcock; "Coals of Galisteo, New Mexico," by Professor B. Silliman; and "Auriferous Gravels of the Upper Rio Grande in New Mexico," by the same.

Sugar Making in Louisiana.

At a recent meeting of the Sugar Planters' Association in New Orleans, the following paper was read by Mr. Mason:

"During the last decade there has been an anxious inquiry from planters and others interested in sugar culture as to the possibility of a more complete and thorough extraction of the saccharine contained in the cane without the attendant injuries that previously followed all former efforts wherein 'inversion' proved so serious an obstacle, and which cast a doubt on extreme extractions ever being rendered profitable to the planters' interests. In Mr. Bouchereau's report of 1870–71, Mr. Edw. D. Seghers queries: 'Whether or not it would pay to throw away our sugar rollers and adopt the system of drawing the juice by the action of hot water, as patented lately in Germany?' Whether this was the first keynote on diffusion, I do not know. I merely mention this item. In 1872–73, Mr. M. S. Bringier, with Dr. J. Albrecht, made experiments on that principle. The 'Mason saturator' was also experimented with this year.

"In 1873–74 Mr. Bringier and Dr. J. Albrecht tried again with a different machine, also the Robert diffusion, at Belle Alliance, and the Mason saturator at the Beka. In 1874–75 Mr. Bringier and Dr. J. Albrecht used another different machine. The Robert diffusion was again used and the Lovejoy-Luling apparatus for diffusion. In 1875–76 the Robert diffusion was inaugurated at the Louisa, and it was said that splendid results were obtained. The Mason saturator was removed to Mr. Spangenberg's, at La Freniere, and Mr. Von Phul reintroduced the Payen jets of steam through the turn plate to the partly crushed cane. In 1876–77 the Robert diffusion, the Mason saturator, the Von Phul, also a nine roller mill of Mr. Bringier and Dr. J. Albrecht, were worked at the Corrinne. In 1878–79 the Robert diffusion, the Mason saturator, and the Von Phul were used.

"In 1879–80 Mr. Bringier, with Dr. J. Albrecht, tested the eleven roller mill at Mr. Godberry's. The Mason saturator and the Von Phul were also used. The Robert diffusion of 1873 produced a yield of molasses of 180 per cent to every 100 barrels of sugar. In 1874 the molasses showed 85 per cent, while in 1875 it was reduced to 61 per cent. The yield of the Mason saturator in 1876–77, according to the *Price Current* yearly report, was 37·5 per cent of molasses. In order to compare this, I have taken the returns of nine prominent plantations, taking the Spangenberg place as the center, so that they shall then range equally as to ripeness of the canes, action of frost and temperature, they all having superior means of evaporation over the evaporators used there, without taking into consideration the excessive strain used on the three roller mill causing its detention for repairs, the souring of its sirups, and the other difficulties encountered by the use of a vacuum from where kettles were used before.

"Grinding commenced in November and was completed in or about the third week of January. This average of the nine plantations amounted to 54·3 per cent, showing 16·8 per cent in favor of the Mason saturator. In 1877–78, that disastrous year to planters, the percentage stood for the Mason saturator at 57, while the nine plantations stood at an average of 113 per cent. The immature canes of this year would, if 'inversion' was the characteristic of the 'saturator,' certainly have condemned its future use. But from this date a change of yield appears: emasculation and interference have somewhat changed its features.

"The yield of Mr. Wilkinson's five roller mill, with his triple effet, stands at 41 per cent, while Mr. Geo. Garr's, with Rillieux apparatus (triple effet), stands at but 30 per cent of molasses to the sugar. I also find that the Howard and Morris mills at the Ashton plantation show a percentage of 42 to the yield of sugar. The yields of juice at the Yale Mill are 64·27; Mr. Wilkinson's, 72·70; and Mr. Godberry's, 68·86.

"I will now state the yield of molasses to the sugar, according to Mr. Bouchereau's report, during the last decade, as follows, as it will tend to show in a measure the maturity of the cane, also the progress made in the introduction of the vacuum pan into the sugar house: In 1870–71 crop, 70 per cent of molasses and 53 vacuum pans. In 1871–72 crop, 86 per cent of molasses, 58 vacuum pans. In 1872–73 crop, 81 per cent molasses, 56 vacuum pans. In 1873–74 crop, 91 per cent molasses, 55 vacuum pans. In 1874–75 crop, 94 per cent molasses, 52 vacuum pans. In 1875–76 crop, 76 per cent molasses, 57 vacuum pans. In 1876–77 crop, 73 per cent molasses, 65 vacuum pans. In 1877–78 crop, 111 per cent molasses, 64 vacuum pans. In 1878–79 crop, 64 per cent molasses, 86 vacuum pans. In 1879–80 crop, 71 per cent molasses, 108 vacuum pans. The yearly average of molasses to sugar, for the decade, being 81·7 per cent. Considerable increase in vacuum pans commenced in 1876, amounting at present to 108, showing an addition of 51. It must be also borne in mind that during this time many old Rillieux pans have been broken up. By information kindly rendered, I find that Messrs. Shakespeare & Smith are erecting for this coming crop a vacuum pan for Mr. Ware, Iberville, and one for Mr. Von Phul, East Baton Rouge; and Messrs. Leeds & Co. are manufacturing them for a number of planters—an addition of 10 vacuum pans for this coming crop of 1880–81, which will give a total of 118 vacuum pans to our State. I did not think it necessary to note each year other evaporators, but it may be as well to state that in 1870 there were 868 kettles, 95 open pans, and 11 Escudier evaporators; 1,105 sugar-houses were in operation, of which 837 were steam and 268 horse power. In 1880 there are 816 kettles, 122 open pans, and 11 Escudier evaporators in 1,111 sugar-houses, of which 837 are steam and 274 horse power, a difference of 6 horse power sugar-houses. In 1870 there were 78 portable mills; in 1879 there were 54 portable mills.

"In the special mention of the Howard and Morris mill by the *Price Current* report, it says, in speaking of the second experiment, there were 181,789 pounds of sugar, and the estimate of the molasses was 46 gallons to 1,000 pounds sugar, 53 per cent, while the general yield of the crop in the column shows but 42 per cent. The Canal Bank having purchased the 'La Freniere,' arrangements have been made to run the Mason saturator this season, so that no doubt may exist. The Roberts diffusion apparatus is being broken up. As to the fate of the others, I have no information."

ENGINEERING INVENTIONS.

Mr. Christian W. Hergenroder, of Baltimore, Md., has patented a surveying and plotting instrument whereby a given route or boundary may be rapidly surveyed and plotted mechanically. In the old mode of surveying on foot only about four miles per day can be accomplished, by reason of the necessarily slow progress which the details of this method permit. This invention contemplates measuring and recording distances, with the curves, and also the elevations and declinations, with as great rapidity as the route can be traversed in an ordinary wheeled vehicle.

Mr. William L. Fisher, of South Saginaw, Mich., has patented an improvement in that general form in which a dog or tumbler holds up a shouldered pin until the dog is struck by the entering link, at which time the dog is removed from the shoulder of the pin and the latter falls of its own weight through the link to effect the coupling of the cars. The invention consists in so constructing the shouldered pin and the dog, and relatively arranging these parts in the draw head, that the shoulder on the pin not only affords a bearing for the dog in holding up the pin, but also, when the pin is down, serves as bearing, which rests directly upon the rounded end of the link and holds the latter in horizontal position while coupling with another drawhead.

Messrs. Alexander K. Suddoth and William L. Canfield, of Friar's Point, Miss., has patented a simple and efficient device for loading wagons, storing goods in warehouses, etc. It consists in the combination of a windlass and a car or carriage with ordinary skids.

An improved apparatus for compressing air has been patented by Mr. Robert M. Catlin, of Tuscarora, Nev. This invention is primarily an improvement in apparatus for elevating water by the direct action of compressed air, such as shown in letters patent granted to the same inventor, No. 221,778, November 18, 1879, but contains features that are applicable in connection with any steam or air engine.

Mr. William Freienmuth, of Lawrence, Kan., has patented a millstone and spindle adjusting device, that will enable the miller to detect at any time if the lower stone is out of level or if the spindle is not at right angles with the grinding surface of the stone, and enable him also to adjust both lower stone and spindle correctly while at work.

HON. W. D. BISHOP, formerly Commissioner of Patents, and more recently President of the New York and New Haven Railroad, has a carriage mounted on bicycle wheels with India-rubber tires. The wheels were made by the Pope Bicycle Manufacturing Company, and are of steel, nickel plated.

IMPROVEMENT IN BILLIARD TABLES.

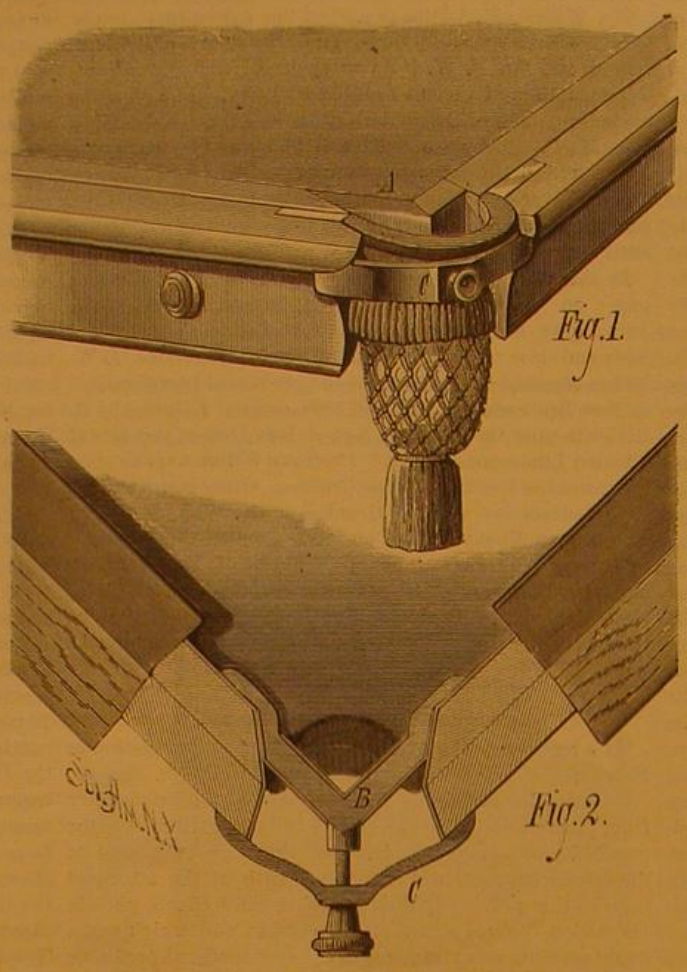
Attempts have been made to apply supplementary sections of cushion to pocket billiard tables for the purpose of transforming them into carom tables, but these efforts have failed because the manner in which the supplementary sections were applied tended to deflect portions of the main cushion or of the supplemental cushion from a true line, and thus interfere with the proper working of the table.

The engraving shows a novel and effective method of securing the supplemental cushion in place without distorting the faces of the cushions. The removable cushion piece, A, is of the usual form, and is fitted so as to fill the gap between the end and side cushion and render the arrangement of the cushions virtually the same as if the main cushions were mitered at the corner of the bed. The supplemental cushion, A, is attached to an angled casting, B (Fig. 2), and is drawn to its place by a screw passing through a yoke, C, which bears against the outer side of the cushion rails.

The side pockets are closed by a straight section of cushion, drawn to its place by a screw passing through a straight yoke.

The advantages of this invention will be readily recognized by those familiar with the requirements.

This device was recently patented by Mr. John Walsh, and is being manufactured and introduced by The H. W. Collender Co., 788 Broadway, New York city.



WALSH'S IMPROVEMENT IN BILLIARD TABLES.

A Powerful Eight-inch Gun.

The *Army and Navy Register* says: "Gen. Stephen W. Benet, Chief of Ordnance, U. S. A., during his visit to Sandy Hook, last week, ordered a continuance of the experimental tests of the eight-inch chambered rifle with which such excellent results have recently been obtained. The gun has already been fired some thirty-five times, but General Benet desires to have it tested still further, and if it sustains the strain of 100 rounds its value will be shown to be very great. These eight-inch guns which were fired with only thirty-five pounds of powder before they were chambered now take a charge of fifty-five pounds, and are capable of penetrating ten inches of iron at a distance of 1,000 yards. These results are very remarkable, when it is considered that the old ten-inch smooth bores, which were converted into eight-inch rifles, were fired with a charge of only sixteen pounds of powder, and with a shot weighing only 120 pounds, while the converted gun takes a charge of fifty-five pounds and a shot which weighs 180 lb."

DOUBLE TREADLE ATTACHMENT.

In running sewing machines and other light machinery in which foot power is used intermittently, a great deal of effort is expended in stopping and starting the machine, and the trouble increases with the increase of size and weight of the moving parts, so that it has been impossible to take advantage of heavy flywheels and a continuous motion. The engraving shows a treadle attachment invented by Mr. D. S. Van Wyck, of Fishkill Plains, N. Y., and recently patented in this country, in Canada, England, France, and Germany. It will be seen that the treadle levers are very long, and the stool upon which the operator sits is inclined so that the greater portion of the weight of the body is on the treadles, and the latter being long the greater portion of the weight is thrown directly upon the eccentrics on the driving shaft of the machine. The treadles are worked with the legs in alternation, the entire muscular force of the leg being available instead of the muscles of the foot and ankles merely as in ordinary treadle mechanism. In this device a heavy fly wheel is employed, and the belt runs over a pulley on the sewing machine, and a tightener and brake which are operated by the knee are used to stop and start the machine, the hands being left free to be applied to the work. The large flywheel is rotated continuously, and the machine head may be stopped and started without making any noticeable difference in the motion of the balance wheel and treadles, thus saving a great deal of labor generally expended in starting and stopping. The movement is similar to that of walking, the weight of the body being transferred from one foot to another, and the exertion is healthful rather than hurtful.

The usual heavy balance wheel on the machine head is replaced by a small pulley, which can be easily stopped and started while the heavy driving wheel continues to rotate, affording an equable motion, and economizing the power applied. The machine is manufactured in Poughkeepsie, N. Y., and will be exhibited at the coming New York State Fair and at the American Institute Fair.

For further particulars address the patentee as above.

Iridescent Glass.

One of the principal manufacturers of iridescent glass is M. L. Clémanpot, who invented and patented the process of producing iridescent effects on glass by the reaction upon it of divers chemical agents under pressure and at a high temperature. Under the name of glass, M. Clémanpot includes all substances resulting from the fusion of silica, which acts as an acid with bases, such as potash, soda, lime, oxide of lead, and the like. In submitting one of these compounds —*e. g.*, glass with a base of potash, soda, lime, or lead—to the action of the different acids, and under a pressure of from thirty to seventy pounds per square inch, iridescent, nacreous, or similar effects, resulting from the decomposition of the glass, are obtained. If among other reactions, under a pressure of from thirty to seventy pounds, water acidulated with hydrochloric acid in the proportion of fifteen per cent of acid is employed, nacreous and iridescent effects resembling those of ordinary mother-of-pearl, or nacre, are obtained. It is said that the same effect can be produced without pressure. The applications of this process are numerous, and include the production of nacre, the manufacture of pearls and opals, imitations of antique glass, and similar work.

VAN WYCK'S TREADLE ATTACHMENT FOR SEWING MACHINES.

MISCELLANEOUS INVENTIONS.

A safety cylinder cock for steam engines that will act automatically to discharge water that may be in the cylinder at any time, and thus avoid the danger arising from the presence of such water, has been patented by Mr. Thomas L. Smith, of Ames, Iowa.

An improved windmill has been patented by Mr. Lewis C. Ashley, of Detroit, Mich. The object of this invention is to furnish windmills simple in construction, inexpensive in manufacture, and not liable to get out of order.

Messrs. Leopold Michel and Charles Schirrmeister, of Brooklyn, E. D., N. Y., have patented an ash box to be placed upon the sidewalk at tenement houses and in other places to receive ashes and garbage. It is so constructed that the ashes may be conveniently sifted as they are being put into the boxes, and the ashes and garbage can be readily shoveled out. The device may be used for coal boxes and for other purposes.

An improvement in book-binding has been patented by Mr. James W. Loveridge, of Jersey City, N. J. The object of this invention is to lighten the expense and labor of binding books by enabling the binder to stamp, gild, or print the covers and back at one operation. It consists in forming a book cover in one piece of a material of uniform thickness to allow the covers and back to be stamped, gilded, or printed at one operation, and grooving the inner side of the back to give flexibility to the back of the book.

An improved apparatus for producing copies of writings has been patented by Mr. Aaron J. Underhill, of Appleton, Wis. The object of this invention is to provide means for producing facsimile copies of writings, drawings, or delineations in a more simple, inexpensive, and expeditious manner than has heretofore been done.

Mr. Theophilus Larouche, of Williamstown, N. Y., has patented an improved thill coupling. This invention consists in a novel construction and form of the pivot of the thill iron, and the combination therewith of a set screw working in the socket of the clip.

Mr. Gustavus O. Goessling, of Jersey City, N. J., has patented an improved dish or plate which is divided into several compartments for the different kinds of food, and with an improved rim to prevent the plates from tipping when several are placed on top of each other.

Mr. Charles W. Allen, of Pine Ridge Agency, Dakota Ter., has patented a hay rake and buncher, so constructed that the hay may be dumped by the advance of the machine.

Mr. William G. Patton, of Park's Station, Tenn., has patented an improved rotary cotton chopper, of which nearly all the parts can be readily constructed, repaired, and replaced by an ordinary blacksmith.

An improved stalk cutter, patented by Mr. Brainerd W. Smith, of Nineveh, Ind., is so constructed as to lay the stalks in proper position and cut them with certainty. The invention consists in combination of devices that cannot be clearly described without engravings.

Mr. Carl W. Stauss, of Coltbus, Prussia, Germany, has patented an improved reed ceiling which is very light and durable. The invention consists in a ceiling formed of two adjoining layers of coarse and fine netting, made of longitudinal reeds and transverse wires attached to strips nailed to the under side of the floor beams and covered with plaster.

Mr. Josias R. King, of St. Paul, Minn., has patented a calendar, which he calls the "Economical Advertising Calendar." Its cost is small compared with those now in ordinary use. It will furnish all information usually contained in calendars, and the information is presented to the eye in a new and compact form.

An apparatus for piercing ears for earrings, so constructed as to facilitate the operation, lessen the pain, and allow the hole to be made in exactly the desired spot, has been patented by Mr. Martin Haller, of Ann Arbor, Mich.

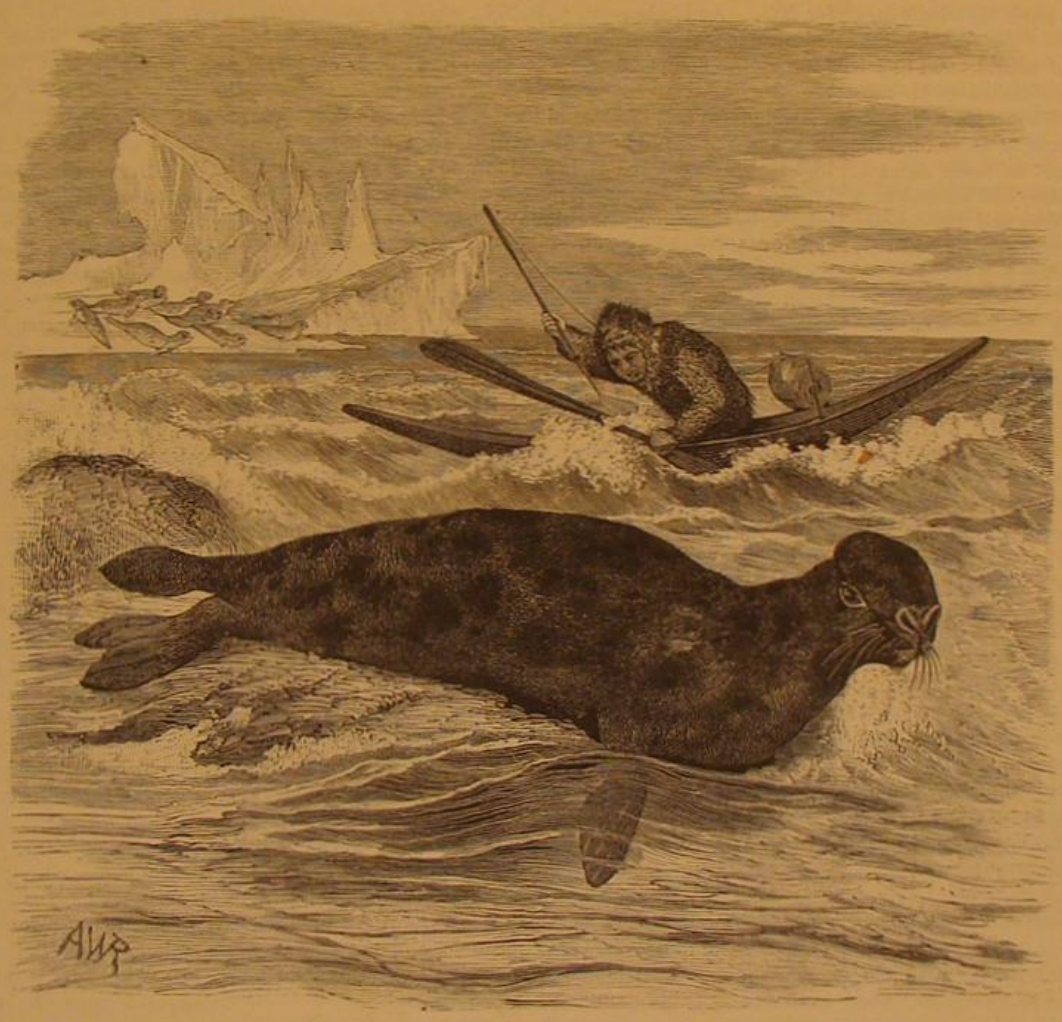
Mr. Denis Minogue, of Chicago, Ill., has patented a snap hook in which the ring can be readily engaged and from which it can be as readily disengaged when desired, but not accidentally.

Mr. Edward B. Carter, of Huntsville, Ala., has invented a device for lifting dead bodies and placing them in the coffin. It consists of two standards having vertically adjustable rods that support a horizontal beam, from which depend straps that may be looped about the body, so that the body may be lifted and moved by persons taking hold of the ends of the beam and raising the beam from off the vertical rods,

SEALS.

BY A. W. ROBERTS.

The bladder-nose seal, or crested seal (*Cystophora cristata*), is an inhabitant of Southern Greenland. From September to March it frequents Davis's Straits for the purpose of bearing and rearing its young, and returning with its offspring in June, in very worn-out and poor condition. In July it takes another excursion, employing its time in regaining its health which it lost during the period of its former absence, so that by September it is very fat. Of late years large and well appointed steamers have been employed in the capture of seals, and many hundred thousands of these beautiful creatures are being murdered every year for their skins and oil. The color of the crested seal, when adult, is a dark blue-black on the back, shading off to a yellowish-white on the under part of the body. A number of large gray patches are scattered over the body, and in the center of each patch is a dark spot. The head, tail, and feet are black. The crested seal attains, when full grown, a length of 12 feet, and is stout in proportion. These seals have a habit of making and preserving holes through the solid ice, and which communicate with the open water. How these animals manage to pass up these perpendicular openings, the insides of which are perfectly smooth and from four to five feet in depth, seems wonderful, yet they accomplish this feat with entire ease. The cyst or crest is common to the male seal only. It extends from the mouth over the upper jaw and the larger portion of the head. It can be inflated with air and emptied at will. When filled it forms a bag or cushion-like protuberance of 25 centimeters in length and 20 centimeters in height. When collapsed it resembles a keel, dividing the nose into two equal portions. The head is large, the snout thick and rotund. After much discussion and nonsense regarding the utility of the crest or cap of this variety of seal, it is generally admitted by naturalists that at present they have not been able to obtain any positive and definite evidence as to its use.



CRESTED SEAL.

In the preparation of the skin of this seal the long coarse hairs have to be removed, leaving only the soft fur adherent to the skin. This is accomplished by heating the skin and scraping it, while hot, with wooden knives.

A young specimen of this seal was purchased by the New York Aquarium some time ago; it lived for a few weeks, dying at last from refusal of food. While in captivity it was very surly and ferocious. When angered it inflated its crest with air.

The seal most common on our Northern and Eastern coasts is known as the harbor seal (*Phoca vitulina*). It was only a few years ago that individuals of this variety might often be met in the East River on their passage from the ocean to Long Island Sound. Even nowadays the bark of the seal at nights is no uncommon sound as near to New York city as Gravesend Bay. The harbor seal is a beautiful animal, with its handsomely mottled skin, and large, intelligent, liquid eyes, and comfortable looking, rotund body, which tempts one to caress and fondle it, and stands it well in point of beauty, grace, and intelligence far above all other members of the seal family.

A fisher friend of mine, living on one of the small islands in the Bay of Fundy, had acquired the knack of "calling" young seals to the side of his dory when tending his herring weirs at night. One of them, so small and plumpy in its baby seal skin and large, wondering eyes, tempted him to steal it from its mother and take it home to his children to raise as a household pet. In course of time the young seal was weaned from the nursing bottle and placed on a diet of young herrings. This seal became greatly attached to all the members of the family, particularly the children, and would show great distress when not allowed to go with them in their boats. He always accompanied his master when tending the herring weirs, either swimming alongside the boat or sitting upright on one of the seats. It would lie for hours stretched out under the kitchen stove. On warm sunny days it would swim off to the neighboring ledges of rocks and mix with its friendly relatives, returning at evening to have a romp with the children in the water.

The Beetle Crop of Southern Russia.

In many parts of Kharkoff, Southern Russia, the only harvest reaped this year has been that of the corn beetle, *Anisoplia austriaca*, many tons of which have been gathered and officially reported. Fifteen years ago this insect pest invaded the northern shore of the Black Sea. The larva is first seen floating on the waves; the final transformation occurs on the sandy shores, and the beetles proceed into the interior in vast swarms, increasing every year the area of their ravages.

How to deal with the evil is one of the great problems of to-day in Russia. Machines of all descriptions have been tried, but have proved more or less worthless, as indeed must all mechanical appliances against a pest so vast that a single field in Kharkoff was calculated in the spring to contain 350,000,000 insects. A short while ago it was said that a fly had been discovered with a propensity for killing corn beetles, and it may be safely assumed that it will only be by means of some such antagonistic insect or by the agency of birds—at present absent from the Russian steppes—that the evil will be ultimately suppressed.

The Flora of Volcanoes.

A traveler in Japan, Prof. Rein, published not long since some interesting observations, showing the distribution of vegetation on the sides of the volcanoes in Japan. This vegetation is continually being transplanted to higher levels, the ripe seeds being wafted upward by wind from the valleys, while to a certain degree, the reverse migration is produced by descending winds.

One of the higher mountain chains in Japan, that of Utaké, forms a group which extends nearly three kilometers from north to east. The southern peak is the youngest, having almost no vegetation, while the northern peak, and even its crater walls, are covered with an abundance of Arctic and Alpine plants. These plants, which have a large size in the plains, decrease in height and beauty as they ascend. A kind of vanguard is formed by *Polygonum weyrichii*, *Stellaria florida*, and *Carex tristis*; then follows usually *Alnus viridis*, with *Pyrus sambrecifolia*, and a remarkable species of *Schizozodon*, which is accompanied by a beautiful Alpine *Campanula*, larger than its European relatives. There are also found at a very great height flowers which are common in the forests of Central Europe. *Vaccinium vitis idæa*, *Oxalis acetosella*, and *Majanthemum* rise to nearly 3,000 meters (9,875 feet). The flora peculiar to Japanese mountains is found somewhat lower, and contains lovely *Ericineæ*, *Saxifragæ*, and many anemones.

This flora seems to have been carried to that country by the winds and streams of the sea, from Kamtschatka and Eastern Siberia.

The Cape Cod Ship Canal.

The long talked of ship canal across the peninsula of Cape Cod, Mass., has been surveyed, and preparations are making for the immediate prosecution of the material part of the work. The canal will be about eight miles long and without locks. It will connect Cape Cod Bay with Buzzard's Bay, and not only shorten the water route between New York and Boston by 90 miles, but will secure an in shore route between these cities practicable for such passenger and freight boats as now ply on Long Island Sound.

It is estimated that there is an average annual loss of 6,000 tons of vessel property, and from thirty to forty lives caused by ship wrecks, occurring around Cape Cod. The canal will be 141 feet wide at the top, and 6 feet wide at the bottom. It will have an average depth of 30 feet.

Vegetable Vessels and their Functions.

The renowned German physiologist, Professor Dr. Joseph Böhm, has recently published a pamphlet in which he expounds a new theory of the functions of the plant vessels. He explains the rising of the sap in the stem by the evaporation on the surface of the plant, and maintains that this evaporation creates a difference of pressure in the neighboring cells, and that consequently the water is drawn up from the lower layers of cells, where it is abundant, into the higher layers which contain only a small quantity. The chief object of his investigations was to ascertain what functions belong to those vessels or tubes which run through the whole lengths of the trunks of the trees, and which, in several kinds of wood, in the oak and maple for example, can be plainly seen with the naked eye in the cross cut. Heretofore these tubes have been taken in all cases for air-conducting organs, and have been called tracheæ, in analogy to the tracheæ of the human body. By careful experiments Professor Böhm has discovered that the vessels of many trees contain sap, not only when transpiration has paused, but at all times, even during rapid evaporation, they contain a quantity of water so great that air cannot be forced through them.

Further, he ascertained that twigs of many plants, of the willow, for example, notwithstanding their liquid contents, are capable of taking in water in such abundance that layers increase their weight twenty per cent within a few days. Now, according to Professor Böhm's theory, the interior of the sap-conducting cells in the unmutilated plant is submitted to a certain pressure, which is the consequence of the resistance which the water experiences on its way from the root to the assimilating leaves; but if the twig is cut liquid finds an easy entrance, and the sap-conducting cells partially suck in the contents of the vessels, while fresh water enters at the cut surface and the weight of the twig is increased. Therefore the tracheæ of the willow and the like are no air pipes, but water channels, which pour their liquid into the sap-conducting cells. These channels are obstructed after the layers have been for a long time in water by cells, the so-called thylls, which lay themselves right across the pipes. When the liquid is no longer conducted in this manner to the upper part of the twigs through the tracheæ, the rapid increase of weight ceases. The reason that the shoots in this state do not perish, but remain alive very often for five or six months without increasing in weight, is because the water ceases to rise through the tube vessels and only moves through the sap-conducting cells, this process being a very slow one. A similar function to that of the vessels of the willow tree probably belongs to the vessels of the horse chestnut, birch, linden, maple, etc., all of which, at the time of rapid transpiration, contain liquids. A series of other experiments with oak, acacia, catalpa, amorpha, and other trees, showed that the tracheæ of the young wood permitted the passage of compressed air, but that through those of old wood neither air nor water could be pressed. The reason for this is to be found in the obstruction of the old vessels by means of thylls or resinous substances. In the old trees the tube vessels are real "tracheæ," for they contained air having the tension of the atmosphere and were entirely without sap. Nevertheless, in such trees also, the streaming of sap from the root to the crown has to be kept up. This is done as in the shoots of the willow trees, whose ends, after a longer cultivation, are obliterated by the thylls; they filter the sap from cell to cell in order to restore the equilibrium between the contents of the superimposed cells which was disturbed during the transpiration. The consequence is that in the higher sap-conducting cells the tension of air must be very low, because, otherwise, the drawing up of the liquid would be impossible. This attenuation of air, at a certain age, finally reaches its minimum, the atmospheric air is given up to the cells from the neighboring vessels, and therewith one factor for the rising of the sap is eliminated. Now, no more water ascends in these tubes, the wood has changed from the sap-conducting alburnum to ligneous fiber. The duration of this process in the different kinds of wood, whose vessels contain atmospheric air, varies. Even in the single individuals of the same species it is hastened or retarded by several causes, such as clime, location, etc.; but the natural death of the tree by

enervation is always the consequence. The feeble layer of live peripheric wood is no longer able to give nourishment to the large crown of the tree, formation of new wood has nearly ceased altogether, and every year a new number of branches die out, while only here and there a desolate twig, whose few leaves have a conspicuous, light color, show that life still lingers in the old trunk, but that in a short time its end will come.

The process is different in those wood plants the vessels of which, even in old age, are still filled with liquid, such as the birch and the willow. Their death is not caused by enervation, but their vessels and tubes, full of sap, enter into a state of dissolution, which is introduced by the action of fungi and other parasites which take up their abode inside of the vessels. Finally decay spreads out more and more, new parts of the healthy wood are attacked and fall into pieces, till a strong blast of wind ends the long disease

BENZOLE.

This name is applied to a lightly oily liquid consisting of equal equivalents of hydrogen and carbon. Since the atom of carbon is twelve times as heavy as that of hydrogen, of course benzole contains twelve times as much carbon by weight as it does of hydrogen. Its percentage composition is: Carbon, 92·3; hydrogen, 7·7. Not every substance, however, having this percentage composition is benzole, for acetylene, a bad smelling gas, has the same composition, and chemists say they are isomeric. To benzole they give the formula C_6H_6, meaning there are six atoms of each element in the molecule, while acetylene has but two of each, and is written C_2H_2. How do they know this? it may be asked. Because the vapor of benzole is three times as heavy as that of acetylene; the former being 39, the latter 13, with hydrogen as a unit.

Before passing on to a description of benzole and how it is made, we must refer to the confusion caused by its having too many names. Faraday, who discovered it in 1825, called it bicarburet of hydrogen, because in those days the atomic weight of carbon was but half as large as now. Next it was called benzene, and this name still adheres to it in England and France, while in Germany and this country it is called benzole. Here the term benzine is limited very properly to the light petroleum oils which boil between 80° and 100° C.

Pure benzole is formed by heating benzoic acid with quicklime. In a less pure form it is obtained when organic matter is highly heated; thus, Faraday found it in illuminating gas made by heating the fatty oils, and Woehler made it by the dry distillation of quinic acid. At the present time it is usually made from coal tar, the refuse of the gas house, in which it was discovered by Leigh in 1842, and by Mansfield in 1847.

Coal tar is a mixture of a great number of different bodies, both solid and liquid. By distillation it is separated into three portions: the first, boiling below 150° C. (302° F.), is called light oil; the second portion is heavy oil, or dead oil, while a sort of pitch remains behind. Benzole is made from the light oil, and the commercial article is very impure, containing only 40 per cent of benzole; the remaining 60 per cent is chiefly toluol, C_7H_8, a substance quite similar to benzole, but of higher boiling point and richer in carbon. This impure benzole makes better aniline dyes than the pure, as we shall afterwards see. By careful fractional distillation a nearly pure benzole is obtained, which is then still further purified by freezing it and pressing out the crystals. Pure benzole boils at 80° C. (177° Fah.), and when cooled solidifies, forming tufts of crystals, which melt at 5½° C. (42° Fah.). It is insoluble in water, but soluble in alcohol, ether, and wood spirits. It possesses remarkable solvent properties, surpassing those of benzene or petroleum naphtha. It is an excellent solvent for India-rubber, gutta percha, the fixed and volatile oils, wax, and camphor; it also dissolves copal, gum lac, sulphur, phosphorus, and iodine, as well as a very large number of organic bodies. It is very inflammable and burns with a smoky flame. Many accidents have occurred from heating or distilling it over an open fire. If it is mixed with two volumes of alcohol it can be used as a lamp oil. When illuminating gas is passed through benzole its illuminating power is greatly increased. An apparatus for enriching poor gas is sold under the name of Woodward's carbureter.

The most remarkable and valuable property of benzole is its ability to form substitution and addition compounds. Chlorine is able to *replace* each and every atom of hydrogen in benzole, and, besides this, one or more atoms of chlorine, to the number of six, can be *added* to the molecule of benzole.

Mono-chloro-benzole, C_6H_5Cl, is formed when chlorine is passed into benzole containing iodine. It boils at 138° C. There are two kinds of dichloro-benzole, one melting at 53° C., the other below zero. There are also two kinds of trichloro-benzole, as well as of the tetrachloro-benzole. Of the pentachloro-benzole, of course, but one form is possible if Kekule's ring-shaped formula is true; yet Jungfleisch and Otto both assert that they have made two kinds. When all six atoms of hydrogen are replaced by chlorine we have a chloride of carbon C_6Cl_6. It is made by pouring benzole on antimonic chloride and then passing in chlorine as long as it is absorbed. It forms silky needles, melting at 220° C.

Thus it will be seen that benzole forms at least nine chlorine substitution compounds. With bromine and iodine it forms nearly as many, although the latter are more difficult to prepare. By the action of chlorine upon benzole in sunlight an additive compound, $C_6H_6Cl_6$, is formed, and in like manner chlorine may be added to the substitution compounds forming such bodies as $C_6H_5Cl_7$ and $C_6H_4Cl_8$.

A much more important series of substitution compounds is that formed by the action of nitric acid on benzole.

Nitro-benzole, $C_6H_5NO_2$, in which an atom of hydrogen is replaced by the NO_2 group, is a yellow oil, heavier than water, and of an agreeable odor, resembling that of bitter almonds. In commerce it is known as essence of mirbane. It is formed when benzole is poured slowly into fuming nitric acid as long as the benzole dissolves. The mixture is then poured into a large quantity of water (in which it sinks) and thoroughly washed. It should next be distilled in a current of steam, and may afterwards be distilled *per se*. On a large scale it is prepared by acting on benzole with sulphuric acid and sodic nitrate, or a mixture of ordinary nitric acid (sp. gr. 1·3) and strong sulphuric acid. It is a violent poison when taken internally, two drops having in one case caused death. When pure benzole is employed in its manufacture the purified nitro-benzole boils at 210° C.; when commercial benzole containing toluol is employed the resulting product is a mixture of nitro-benzole and nitro-toluol, and boils at a much higher temperature.

When nitro-benzole is acted upon by a mixture of sulphuric and fuming nitric acids, a solid dinitro-benzole is formed, which crystallizes in long needles. It is soluble in alcohol, but insoluble in water.

In addition to the two nitro-benzoles, there are several nitro-chloro-benzoles, as well as nitro-bromo and nitro-iodo compounds.

The nitro-benzoles are readily converted, by means of reducing agents, into amido compounds by substituting NH_2 for NO_2. Amido-benzole, $C_6H_5NH_2$, which is much better known under the name of aniline oil, is prepared on a large scale by the action of acetic acid and iron filings on nitro-benzole.

Aniline was first discovered by Unverdorben in Saxony in 1826, among the products of the distillation of indigo. In 1833 Runge discovered it in coal tar, and called it kyanol. In 1842 Zinin, recently deceased, prepared it from nitro-benzole by reduction with sulphhydric acid; he called it benzidam. A. W. Hofmann, of Berlin, subsequently proved the identity of all these substances. The name aniline was given to Unverdorben's new compound by Fritzsche from *anil*, meaning indigo.

Pure aniline is a colorless liquid of bitter taste and unpleasant odor, which soon turns brown in the air. It boils at 184·8° C. The admixture of toluidine, etc., raises its boiling point.

When heavy aniline oil of higher boiling point is treated with certain oxidizing substances it is converted into a base called rosaniline or fuchsine, $C_{20}H_{19}N_3$, the salts of which have a beautiful green color when solid, a magnificent red when in solution. Arsenic acid is the reagent mostly employed in making rosaniline, although corrosive sublimate, nitro-benzole, and perchloride of tin are also used. A description of the methods employed in the manufacture of the aniline colors would far exceed the limits of our present article.

Diazo-benzole is a benzole derivative containing, as the name implies, two atoms of nitrogen. It is obtained as a nitrate by passing nitrous acid gas into a solution of the nitrate of aniline. Also as the hydrochlorate by dissolving aniline in an excess of hydrochloric acid and adding potassic nitrite. In a dry state the diazo compounds are dangerously explosive, and even in solution undergo spontaneous decomposition. By the action of various diazo compounds upon the phenols, Griess has obtained a great variety of dyes, some of them quite interesting and beautiful, and still they come. James H. Stebbins, Jr., of this city, has also made a number of dyes from diazo compounds.

Sulphanilic acid, $C_6H_7NSO_3$, is formed by the action of sulphuric acid upon aniline at a high temperature; in the cold only sulphate of aniline is formed. It crystalizes from hot water in rhombic plates. Two other acids having the same composition may be obtained, the one from sulpho-benzoic acid, the other from nitro-benzole. In making the former acid, sulpho-benzoic acid is first converted into a nitro-sulpho-benzoic acid, and that reduced to amido-sulpho-benzoic acid. It crystallizes in white needles.

In the above sketch we have described but a few of the most important derivatives of benzole. The list might be prolonged to an almost limitless extent by adding the various chloro and nitro derivatives of each of the above compounds, the acids derived from them, their salts, ethers, and esters; but these must wait until they have become of greater industrial or technical importance than they are at present, before they can claim a place in our crowded columns.

The Leather Industry of Philadelphia.

One of the oldest of the staple industries in Philadelphia is the manufacture of Morocco leather, which began early in the present century, and was an outgrowth of the East India trade that once distinguished that port, and continued fitfully until 1861. The Morocco leather manufacture, however, grew steadily, and is now more prosperous than ever before. There are thirty establishments, says the *Public Ledger*, making goat skin Morocco to the value of $5,056,000 for the last year, as compared with twenty-three in 1870, then producing $2,307,113 in value. The improvement effected by the introduction of steam machinery has given most of this increase, and the demand for fine leather in shoe manufacture takes all that the factories can produce. A few cases have been sent to foreign markets, but it is not a regular trade, as the export of sole leather has become. More than half the supply of sumac, the chief tanning material, is now produced in Virginia; formerly it was all brought from Sicily.

Next to the Morocco manufacture is that of calf-kid and glove-kid, nine factories producing $1,050,000 in value, as compared with $574,043 in 1870. A still larger product is that of colored and fancy leathers, bindings, and linings, chiefly of sheep skin, fifteen establishments producing $1,500,000 in value, as compared with $1,133,568 in 1870. The tanning of heavy leather, sole and upper, has declined, and many of the old yard tanneries have disappeared. But six or seven remain, producing $314,000 in value, as compared with $523,000 in 1870. A large industry remains in currying and preparing leather, although this has declined under the competition of the great steam tanneries of the interior of the State. The produce of about twenty of those tanneries is regularly sold in Philadelphia, one-half of it for export to foreign countries. The value, so handled, is about $6,000,000, and is increasing.

The only feature of the old order of things remaining is the importation of French and Belgian calf skins, which continues at about $750,000 in value yearly, although in the manufacture of calf-kid and like leathers here, the Alsatian and Belgian workmen, transplanted bodily to Philadelphia, give to Canal street and St. John street the air and flavor of the most ancient city of the continent. The only thing lacking, it is said, is time. The continental tanner has months or years before him without limit, whereas time with us is cut off at both ends, and the leather must be out of the tannery in a month. So Philadelphia brings into North Third street every year half a million dollars' worth of the best products of the North of France and adjacent Germany, leaving the poorest for Europeans to wear, because our bootmakers will have the best of French calf skins, or none at all.

In manufactures of leather, including every form of cut leathers in belting, bands, harness, straps, etc., the industry is conducted with great activity. Belting is made for export, and the clean and perfectly finished belts of Pennsylvania leather are now driving machinery in England and Scotland, in Sweden, and in Australia. Even the great factories of Mulhouse would have procured 46-inch belts here if they could, but in France the importation of manufactures of leather is prohibited.

In leather strictly, embracing none but finished forms, the total value of that manufactured for the past year is $8,000,000—an increase of 33 per cent over 1870. The establishments are little subject to depression, and rarely to disturbance. Whatever may happen to other departments of business, the special forms of leather made in Philadelphia are always in demand, and there is no record of a corner in the market for Patna or Tampico goat skins.

MECHANICAL INVENTIONS.

Mr. Freadrick P. Danunhauer, of Philadelphia, Pa., has patented an improved apparatus for dyeing yarns which consists, first, in a series of nipping rollers hung on vibrating arms and fitted for movement to and from the supporting bars of the yarn to draw the yarn around the bars a regulated distance at each vibration; second, in an automatic stop motion for shifting the driving belt and stopping the mechanism when the desired number of turns have been given to the skeins, so that they may be removed.

An improved retracting device for the picker sticks of looms has been patented by Mr. James J. Geoghegan, of Westerly, R. I. The object of this invention is to provide a simple, durable, and inexpensive device for pulling back the picker sticks of looms, whereby the expenses and delays consequent upon the frequent breaking of the ordinary picker stick spring will be avoided. The invention consists of a rocking lever to one end of which the picker stick is connected, while to the other end weights or springs are attached to pull back the picker stick after each forward motion.

Messrs. Richard Matthai and Charles A. Clinton, of San Francisco, Cal., have invented a simple device for indicating to railroad car passengers the names or numbers of streets and stations on the line of the road as the car approaches them. The invention consists of a box or case containing rollers over which is rolled an index strip having the names or numbers of the streets and stations printed on it, which names or numbers are exhibited in proper succession through an aperture in the box as the rollers are revolved; and also of a novel combination of wheels, springs, levers, and other devices, whereby the said rollers are moved and a bell simultaneously sounded when desired.

Causes of the Present Figure of the Earth.

The *Comptes Rendus* of the French Academy contains a remarkable paper by M. Faye on the physical forces which have produced the present figure of the earth. After remarking on the use of the pendulum in determining the figure of the earth from series of measurements of the intensity and direction of the gravitation force at different parts of the earth's surface, he draws attention to the very curious fact that while the direction and intensity of gravity are affected perceptibly by the presence of hills such as Schichallion and Arthur's Seat, or even by masses as small as the great pyramid of Gizeh, gigantic mountains such as the Himalayas, and great elevated plateaux and table lands, do not affect the pendulum indications in any sensible man

ner, except in certain cases where upon elevated continents there appears to be a veritable defect of attraction instead of the excess which might be expected. Indeed, the observations are sufficiently striking to seem to point to the supposition that not only under every great mountain, but even under the whole of every large continent, there were enormous cavities. More than this, the attraction at the surface of all the great oceans appear too great to agree with the distribution presumed by Clairant's formula, which is exact enough for most purposes. Sir G. Airy's suggestion that the base of the Himalaya range reaches down into the denser liquid interior, and there displaces a certain amount of that liquid, so that the exterior attraction is thereby lessened, is one which, inherently improbable, fails to have any application in explaining why the attraction above the seas should be greater than over the continents. M. Faye propounds the following solution to the difficulty: *Under the oceans the globe cools more rapidly and to a greater depth than beneath the surface of the continents.* At a depth of 4,000 meters (13,000 feet) the ocean will still have a temperature not remote from 0° C., while at a similar depth beneath the earth's crust the temperature would be not far from 150° C. (allowing 108 feet in depth down for an increase of 1° in the internal temperature). If the earth had but one uniform rate of cooling all over it, it would be reasonable to assume that the solidified crust would have the same thickness and the same average density all over it. It is therefore argued that below the primitive oceans the earth's crust assumed a definite solid thickness before the continents, and that in contracting, these thicker portions exercised a pressure upon the fluid nucleus tending to elevate still further the continents. This hypothesis, M. Faye thinks, will, moreover, explain the unequal distribution of land and sea around the two poles, the general rise and fall of continents being determined by the excess of density of the crust below the oceans, and by the lines or points of least resistance to internal pressure being at the middle of continents or at the margin of oceans.

How the Pyramids were Built.

Brugsch Bey, the eminent Egyptologist, says, in his work on Egypt:

From the far distance you see the giant forms of the pyramids, as if they were regularly crystallized mountains, which the ever-creating nature has called forth from the rock, to lift themselves up toward the vault of heaven. And yet, they are but tombs, built by the hands of men, which have been the admiration and astonishment alike of the ancient and modern world. Perfectly adjusted to the cardinal points of the horizon, they differ in breadth and height, as is shown by the measurements of the three oldest, as follows: 1. The Pyramid of Khufa—height, 450·75 feet; breadth, 746 feet. 2. Pyramid of Khafra—height, 447·5 feet; breadth, 690·75 feet. 3. Pyramid of Menkara—height, 203 feet; breadth, 352·78 feet.

The construction of these enormous masses has long been an insoluble mystery, but later generations have succeeded in solving the problem. According to their ancient usages and customs, the Egyptians, while they still sojourned in health and spirits, were ever mindful to turn their looks to the region where the departing Ra took leave of life, where the door of the grave opened, where the body, well concealed, at length found rest, to rise again to a new existence, after an appointed time of long, long years, while the soul, though bound to the body, was at liberty to leave the grave and return to it during the daytime, in any form it chose. In such a belief, it was the custom betimes to dig the grave in the form of a deep shaft in the rock, and above this eternal dwelling to raise a superstructure of sacrificial chambers sometimes only a hall, sometimes several apartments, and to adorn them richly with colored writings and painted sculptures, as was becoming to a house of pleasure and joy. The king began his work from his accession. As soon as he mounted the throne, the sovereign gave orders to a nobleman, the master of all the buildings of his land, to plan the work and cut the stone. The kernel of the future edifice was raised on the limestone soil of the desert, in the form of a small pyramid built in steps, of which the well constructed and finished interior formed the king's eternal dwelling, with his stone sarcophagus lying on the rocky floor. Let us suppose that this first building was finished while the Pharaoh still lived in the bright sunlight. A second covering was added, stone by stone, on the outside of the kernel; a third to this second, and to this even a fourth; and the mass of the giant building grew greater the longer the king enjoyed existence. And then, at last, when it became almost impossible to extend the area of the pyramid further, a casing of hard stone, polished like glass, and fitted accurately into the angles of the steps, covered the vast mass of the sepulcher, presenting a gigantic triangle on each of its four faces.

More than seventy such pyramids once rose on the margin of the desert, each telling of a king of whom it was at once the tomb and monument. Had not the greater number of these sepulchers of the Pharaohs been destroyed almost to the foundation, and had the names of the builders of these which still stand been accurately preserved, it would have been easy for the inquirer to prove and make clear by calculation what was originally, and of necessity, the proportion between the masses of the pyramids and the years of the reigns of their respective builders.

ALUM and plaster of Paris, well mixed in water and used in the liquid state, form a hard composition and also a useful cement.

Correspondence.

Protection from Lightning.

To the Editor of the Scientific American:

In your paper of August 28 is an article written by Professor Kirchoff, on connecting lightning rods with gas and water mains, in which, after citing a case of lightning destroying several lengths of cast iron water pipe in Basch, he proceeds to state that if the said pipes had been joined with *lead* instead of pitch, no mechanical effects could have been produced.

That the assumption of Professor K. is not justified by the facts is proved by the following cases:

A church in Terre Haute, Indiana, was struck by lightning, the rod knocked down, after which the electricity followed the gas pipes in the church to the mains in the street, and melted the *lead* joints for upwards of one thousand feet.

Another church in Iowa City, Iowa, received a heavy discharge, which damaged the rod, ran on the gas pipes, and thence to the main, and for a distance of several hundred feet every particle of the *lead* joints was burned out.

Other cases might be cited, but these are sufficient to prove that *lead joints* do not prevent mechanical effects when lightning passes over gas pipes.

Another correspondent, in the same issue of your paper, J. C. M., of Bradford, Pa., writing on the subject of protecting oil tanks from damage by lightning, says:

"We would only be too glad to learn of some method other than the old theory, by which we could protect our property from lightning, as that has been demonstrated beyond a doubt to be a failure. We want information on the subject."

J. C. M. is only one of many thousands seeking such information, and it certainly should be forthcoming from some of our scientists. Of what practical value to the human family has been the vast amount of knowledge accumulated on the subject of atmospheric electricity within the last forty or fifty years? Our scientists have studied its modes of action until all agree upon the laws which govern it; yet, so far as protection from lightning is concerned, this knowledge has not helped us forward one single step. The scientific world has demonstrated clearly, and have taught us by their writings for half a century, that what is known as *electric induction* is a universal mode of electric action.

Scientists have also clearly proved that Franklin knew nothing of this law of electric induction, hence that his theory regarding the action of atmospheric electricity was erroneous. Is it not strange, then, that our scientists should to this day countenance a system of lightning protection (so-called) suggested and recommended by Franklin, and which, by him, was based upon what has been so clearly proved to have been an erroneous theory? Is it reasonable or logical to expect protection from a system founded upon such a basis? Had the great Franklin understood electric induction, his wonderful intuition would have enabled him, without doubt, to suggest the proper method of constructing apparatus for protecting our property from lightning.

Electric induction is theoretically acknowledged and taught by all scientific authorities, yet when the subject of devising some practical system of protection from lightning is under consideration, these same authorities as completely ignore this law of electric induction as did Franklin, who, they prove, knew nothing about it.

Before we can hope for any efficient system of protecting our property from the dire effects of the lightning stroke, it must be clear to inquiring minds that we must no longer ignore this wonderful law of electric action known as electric induction, but must keep it ever before us and recognize it as an all-important and indispensable factor in our investigations. Any other course must result in the future, as it has in the past, in total failure. J. H. A.

Cleves, Ohio, September, 1880.

REMARKS.—Our correspondent's letter is chiefly valuable in reporting the two churches that were struck, the rods of which were connected with the underground gas pipes. It is undoubtedly true that lead is a poor conductor, and that when a heavy discharge of electricity passes along leaded pipe joints, mechanical effects will sometimes be produced. The object in connecting the rods with the gas pipes is to enlarge the connection of the rods with the earth, and thus to protect life and property in the building. If this is accomplished (and it seems to have been done in the cases cited by our correspondent) then the temporary mischief resulting to the lead joints is of no importance, as it may be readily repaired. The connection of the rod with water or gas pipes is recommended, although lead joints are known to be electrically bad, because such pipes usually form the best available means of connecting the rods with the ground.

Our correspondent assumes that Franklin was an ignoramus in respect to atmospheric electricity, and that his system of protection by lightning rods is good for nothing, not being based, as he supposes, on the "wonderful law of electric induction."

We think the probable difficulty is with our correspondent and not with Franklin, who was not, as our correspondent assumes, ignorant concerning atmospheric electricity. Franklin's original instructions relative to lightning rods have been proven by experience to be substantially correct; furthermore, they agree with the theory of "electric induction," and are as sound and good in practice to-day as they were when first published by the illustrious inventor in 1753. Franklin taught that in order to protect buildings the rod should be carried down into moist earth; and the proper inference from his instructions is that he considered it essential that the bottom of the rod should always be well grounded in the earth. All experience with rods since Franklin's time proves the correctness of this idea; and in almost every case where rods are used and damage is done, it is found that the earth connection of the rod was bad, and that Franklin's directions were not followed.

When our correspondent can produce an authentic example of a properly-rodded building, having its rods and metals thoroughly connected with the earth, that has been seriously damaged by lightning, then it will be time enough for him to assume that Franklin knew nothing about the subject, and that his lightning rods are of no account.—EDS. SCI. AM.]

COUNT LOUIS FRANCOIS DE POURTALES.

Science has recently met with a heavy loss in the death of Count Louis François de Pourtales, which occurred at Cambridge, Mass., July 18. His strong frame and temperate mode of life gave hope of a long period of usefulness, for he was only fifty-seven, and in the prime of his powers; but, stricken by an obscure internal disease, he succumbed after some weeks of suffering, and thus followed his teacher and companion, Louis Agassiz, after seven short years. Count Pourtales was a Swiss representative of an old family, which had branches also in France, Prussia, and Bohemia. He was educated as an engineer, and in early manhood emigrated to the United States at nearly the same time as his subsequent fellow worker, Agassiz, to whom he was warmly attached. He entered the government service in the department of the Coast Survey, and continued in it many years. Almost from the beginning of his duties therein he deeply interested himself in deep sea questions, and some of the earliest observations on the nature of the deep sea bottom and of Globigerina mud were made by him. By the death of his father, Pourtales succeeded to the title and received a fortune which enabled him to devote himself entirely to his favorite studies, and to do much in continuing the great work of Louis Agassiz. Receiving the appointment of Keeper of the Museum of Comparative Zoology, he devoted himself untiringly to carrying out the arrangement planned by his friend and master. Dividing the task with the curator, Alexander Agassiz, he pushed forward his part of the work with the easy power of a strong and highly trained intellect, and was the very model of an administrative officer. In 1871 he published (in Catal. Mus. Comp. Zoology, iv.) what is probably his best known work—"Deep Sea Corals"—a memoir containing valuable disquisitions on the affinities of various genera, notes on the distribution of species, and the nature of the bottom on which the dredgings were made. A second memoir on the same subject was contributed by him to the account of the zoological results of the Hassler expedition, and many others in this and other zoological subjects are to be found in the Bulletin of the Harvard Museum of Comparative Zoology. His last work is a description of the plates of corals in the Report on the Florida Reefs by the late Professor Agassiz, which has just been published by Alexander Agassiz, through the permission of the Superintendent of the Coast Survey. These plates are the most perfect and beautiful representations of corals that have as yet been published anywhere, and were drawn under the immediate direction of Professor Agassiz. Count Pourtales' name is indissolubly connected with deep sea zoology by means of the genus *Pourtalesia*, which was dedicated to him. The *Pourtalesia*—a sea urchin allied to *Anaschytes*—was found by the Challenger expedition to be one of the most ubiquitous and characteristic of deep sea animals, and numerous species new to science were obtained by the expedition.

Pourtales' range of learning was very extensive, and his command of it perfect. Nor was it confined to mathematics, physics, and zoology. He did not scorn to read novels and light poetry, and was knowing in family anecdotes and local history. It was a common saying in the museum that if Count Pourtales did not know a thing it was useless to ask any one else.

RECENT INVENTIONS.

An improvement in hoppers in which grain or middlings, etc., are placed to be fed to crushing rolls, purifiers, or other milling machinery, has been patented by Mr. John T. Cook, of Jordan, Minn. One side of the hopper is hinged and movable, and the invention consists in the combination, with the hinged part, of devices, which allow it to yield to the pressure of the grain or middlings and swing outward, but restrict its movement within certain limits, so that the grain shall not discharge too rapidly.

An improved thread case, which exhibits the thread to the greatest advantage, and permits of getting any desired kind of thread instantly and easily, has been patented by Mr. Eugene L. Fitch, of Breda, Iowa. The invention consists in a case with a glass front and top, and with a floor inclined from front to rear, and provided with a series of drawers, each containing a number of spools of thread which are held by spring catches at the end of the drawer, so that if a button on the drawer is pulled a corresponding spool will drop from the drawer and roll down the inclined floor toward the salesman.

A combined door plate and letter receiver, patented by Mr. Henry Free, of Lewiston, Me., is so constructed as

to keep rain, snow, wind, and cold from entering the opening in the door, and it will allow the name or number to be readily changed.

An improved book holder, which is simple, effective, and convenient, has been patented by Mr. Wilhelm F. Eppler, of Herrstein, Germany. It is formed of a box, for lunch or other articles, and of two boards, between which the books are placed. All the parts are held together by cords attached to a slate placed below the lunch box or to the box itself, and are wound upon the revolving handle of the book holder.

Mr. Benedict Beehler, of St. Louis, Mo., has patented a lumber polishing machine, which is more particularly intended for polishing thin lumber, such as is used for making cigar boxes, and for similar purposes. It consists in a novel arrangement of a stationary bed plate and a tightly-journaled cylinder, whereby provision is made for simultaneously polishing both sides of the work as it passes through the machine.

REASONABLE DILIGENCE.

A very recent decision of the Supreme Court, at Washington, strikingly illustrates the importance of an inventor's using reasonable diligence and promptness in prosecuting his application. It is well understood that delay in this respect does not necessarily forfeit one's rights. Inventors may, if they can, keep their inventions secret, and if they succeed in doing so, no postponement of the application for a patent will deprive them of their right to one. The delay may be satisfactorily explained or excused; as where poverty, sickness, absence from the country, or the like, hinders early action. But, generally speaking, whoever has sufficiently matured a valuable invention will do well to seek a patent without dallying, as Mr. Woodbury in the case now to be narrated, has learned.

In the fall of 1846 Woodbury completed an improvement in planing machines. The nature of it is not important to the story; it involved the introduction of a "yielding pressure bar" to keep the wood to be planed firmly in position, instead of the rollers employed in previous machines constructed on the "Woodworth" general plan. It was a real improvement; and, as developed in other hands, has now acquired value.

But in 1848, when Woodbury filed application for a patent, his invention seems not to have been appreciated. It was rejected (in 1849), and he was notified he might "withdraw or appeal." He did not appeal. In 1852 the attorney through whom the application was made withdrew it. This was done without authority, to be sure, but Woodbury made no attempt, when informed, to have the case reinstated. Meantime he took out other patents, showing that he was not prevented from acting in the matter by ill-health or want of money. At last, in 1870, he renewed the application, and a patent was (in 1873) granted. He organized a company, which commenced introducing the machine to profitable use. But meantime the principle of the invention had been adopted by other persons. The planing machine company sued these for infringement; and one of them resisted the suit on the ground that Woodbury's delay was an abandonment of his invention to the public.

The Supreme Court has sustained the defense. They say that there is no rule requiring intention to abandon to be declared in words. It is the unquestionable right of an inventor to confer his invention upon the public, and this he may do by his conduct, and may do it after applying for a patent as well as before. The patent law requires him to be vigilant and active in taking steps to procure a patent if he desires one. He cannot, without cause, hold his application pending during several years, leaving the public uncertain whether he intends to prosecute it, and yet keeping the field closed against other inventors. It is not unfair to one who has for many years neglected a claim, that the public and the courts should treat it as abandoned.

THE CAUSES OF TERRESTRIAL MAGNETISM.

In his memoir entitled "Theory of Electric Phenomena," Mr. Edlund has explained the galvanic effects by a current of ether in the circuit, and the electrostatic phenomena by condensations and rarefactions of this ether. If this explanation is correct, then it follows that an isolating body moving with a celerity similar to that of the ether in a galvanic current must produce the same phenomena. To verify this idea Mr. Selim Lemström has constructed a paper tube with two concentric walls, which can be rapidly moved round a cylinder of soft iron which is freely suspended in the direction of the vertical axis of rotation. In employing a pair of astatic needles furnished with a mirror and suspended on a very fine silver thread, this gentleman has succeeded in ascertaining that this double-walled paper tube acts like a galvanic current and magnetizes the soft iron cylinder in the one or the other sense according to the direction of the rotation.

According to the geologists, the crust of our earth has two per cent of iron, and supposing that all the magnetic molecules are concentrated in one layer forming the inside of this crust, then this crust of magnetic matter would have the thickness of about 1 kilom. (five-eighths of a mile). This magnetic layer, which is about 30 kilom. (18·75 miles) below the surface, having nearly the shape of a sphere, may be considered, as regards its magnetic effect, as a real sphere when influenced by a certain force.

The earth being a magnetic body, suspended in the ether and turning around its own axis, will, from a magnetic point of view, be magnetized in the same way as if it were itself at rest, while the ether would move around it in an opposite direction. Going out from this theory, after finding by calculation the force which guides this molecular magnet following the axis of the earth, and after ascertaining the magnetic momentum, we have mathematical values which, corresponding to the formula of Gauss, explain the position of the magnetic axis of the earth, as well as its secular, annual, and daily variations, and which are in perfect accordance with the accidental phenomena, such as magnetic tempests and the aurora borealis.

THE LOCATION OF THE LICK OBSERVATORY.

In his report to the trustees of the James Lick Trust, with reference to his observations on Mount Hamilton, California, to determine the suitability of the summit of that mountain for the site of the proposed observatory, Mr. S. W. Burnham concludes that it offers advantages superior to those found at any point where a permanent observatory has been established.

Mount Hamilton is thirteen miles due east (in an air line) from San José, Cal., the latter place being fifty miles south of San Francisco. The summit of the mountain is reached by a well-constructed highway, carried up by a circuitous route twenty-six miles long, and nowhere exceeding a grade of six feet in the hundred. The sides of the mountain, in most directions, are very steep, and form an acute angle at the summit, which is 4,250 feet above the level of the sea. The view from the peak is unobstructed, there being no higher ground within a radius of 100 miles. The atmosphere of the region is marvelously clear; indeed Professor Davidson, of the U. S. Coast Survey, in his work in the Sierra Nevada, at an altitude of 10,000 feet, was able to see with the naked eye the five-inch mirror of a heliotrope 175 miles distant.

Mr. Burnham had at his temporary observatory a six-inch refractor by Alvan Clark & Sons, with eyepieces giving powers up to 400; also a full set of meteorological instruments. He remained on the mountain from August 17 to October 16, with an absence of three nights in September. During these sixty days there were forty-two nights that were first-class for astronomical purposes, seven medium nights, and eleven that were cloudy and foggy. There was not one clear night when the "seeing" was not good. In the opinion of Professor Davidson, based on the observations and experiences of the members of the Coast Survey, good seeing may be expected 250 nights every year, and 150 of those nights will be such as are rarely experienced in the east. Though his telescope was a small one, and his positive micrometer (made to order for double star work by a prominent London optician) "combined more features which should be avoided in an instrument of the kind intended for actual service than were ever found in any other micrometer," Mr. Burnham was able during his short stay on the mountain to discover forty-two new double stars, and to make micrometer measures of ninety. Five wide pairs previously catalogued by Herschel, Struve, and South, were found to be close groups of three; and six of the new double stars are prominent well-known stars visible to the naked eye.

These discoveries, Mr. Burnham justly observes, show better than anything else can what may be done at Mount Hamilton. "Remembering," he continues, "that they were discovered with what, in these days of great refractors, would be considered as a very inferior instrument in point of size, we may form some conception of what might be done with an instrument of the power of that at the Naval Observatory, having a light power about nineteen times as great, or with the proposed Pulkowa glass of twenty-five times the power."

Two Disastrous Hurricanes.

A furious hurricane ravaged the Island of Jamaica on the afternoon and night of August 18, causing a vast amount of damage. The storm struck the northern side of the island, shifted to the northeastern side, then to the southeastern coast, whence it traveled westward. In two hours the wind increased from two miles an hour to eighty miles, and during the day the barometer fell a full inch.

Forty-three of the forty-five vessels lying in Kingston harbor when the storm broke were destroyed, and most of the shipping along the coast was wrecked. Scarcely anything material was able to withstand the force of the wind. Public buildings were demolished in an instant. The debris was whirled high into the air and conveyed to a great distance from the structure to which it originally belonged. At Raetown, for instance, a sheet of iron roofing, weighing upward of half a ton, was lifted to a height of fifty feet, rolled up like a stick of cinnamon, and was carried a distance of 130 feet from the building which it had covered. Cocoanut groves were entirely swept away, and the fruit crops in the places visited by the storm were entirely destroyed.

Wherever the cyclone struck the plantations were completely desolated. Looking inland from Port Antonio, it is said, a man can see for a distance of fifteen or twenty miles; and in the whole of that space not a growing plant, cocoanut, breadfruit, banana, cane, corn stalk, or yam vine has been left. The coffee bushes are torn and stripped of their berries. Thousands of cocoanut trees have been blown down on single plantations. The cyclone leveled hundreds of houses and churches. The reports show that in St. George District, Portland, 131 houses were wrecked, at Yallatis fifty-nine houses; in Bath District fifty houses, in the Parish of St. Catherine every church and many houses; at Newcastle twenty houses; and so on along about 200 miles of the coast. At Kingston the damage done is estimated at $600,000, and the sum total of loss by the cyclone is appalling.

Famine is feared in the districts devastated, so general was the destruction of the coffee, fruit, and food crops.

A hurricane, said to have exceeded in destructive violence the historical hurricane of 1839, swept over the islands of Bermuda, August 29 and 30. Many houses were wrecked and the entire fruit crop was destroyed. Great damage was also done to the public works, including the causeways. Many vessels in the path of the storm were wrecked, both around the islands and along the Florida coast, where the hurricane raged with great violence. The greatest loss of life attended the founding of the passenger steamship City of Vera Cruz, of the New York and Havana line. Of seventy passengers and crew but 13 were washed ashore alive, after battling with the sea for 24 hours or more.

Antimony in California.

Hitherto no workable ores of antimony have been known in this country, the chief source of the metal being the Sarawak Mine in the Island of Borneo. Ten years ago, while prospecting in Kern County, California, Mr. E. J. Weston discovered the sulphuret of antimony in an old mine worked long ago by a Jesuit society for gold. The property has since been purchased by Mr. S. Boushey and his two sons. The ore thus far taken out has been sent to France to be refined, and recently Mr. Boushey passed through this city on his way to California, having just returned from Paris, whither he had been to make arrangements for the erection of reduction works at the site of the mine. As described by Mr. Boushey to the *Sun*, the mine lies in Kern County, as above stated, thirty-five miles south of Bakersfield, near Sumner Station, on the Southern Pacific Railroad. Between the head-waters of the San Emidio and the Pleito Cañons there is a mountain face which for four miles consists of granite and porphyry covered with fertile earth and heavily timbered with pine. The ledges of granite and porphyry run parallel with the face of the mountain and slant with it at an angle of nearly forty-five degrees. The antimony is found in a true fissure, of which there are only three other instances in the world. There is one in Freiberg, one in Chili, and one in Mexico. This fissure is the result of the upheaval of what may be called one end of the mountain, or of the depression of its center. It strikes directly through the mountain at right angles with the granite and porphyry ledges. The ores with which it is filled were thrust up into it from below. At the top it is from thirty to one hundred feet wide, but it widens as it descends. The fissure has been traced across the top of the mountain five thousand feet, and antimony has been found at every point.

Mr. Boushey says that he has pushed four tunnels into his mine, one of them seventy-eight feet long. The rock is not hard, and one man is able to get out half a ton of it a day, carrying from thirty to sixty-five per cent of antimony.

A Great Bridge Reconstructed.

The great work of reconstructing the famous railway suspension bridge across the Niagara river has just been completed without interruption of traffic. The task was undertaken some months ago by Engineer E. A. Buck, and, though many prominent engineers doubted the feasibility of the plan, he has carried it out, making an iron and steel bridge out of a wooden bridge by a process of substitution which has not occasioned the slightest interruption of trains. The casual observer would never have suspected that anything more than a little repairing was going on.

The Bradford and Buffalo Pipe Line.

The United Pipe Line Company has recently completed an oil pipe line between Bradford and Buffalo. The pipe is 3 inches in diameter, and will transmit 125 barrels an hour. There are pumping stations at Cattaraugus and North Collins. Extensive refining works are being put up in Buffalo. A system of racks for loading tank cars and capacious tanks have been erected in East Buffalo. The racks are built along the railroad tracks a distance of about 500 feet, and there are 24 spill pipes for discharging oil into the cars.

The Long Bridge over the Volga.

The long bridge over the Volga, on the Syoran and Orenberg Railway, Russia, has just been finished. The river at the point is nearly a mile wide and fifty feet deep, and is subject to very heavy floods. Accordingly the fourteen piers carrying the bridge had to be built one hundred feet above the mean level of the water. The girders, three hundred and sixty-four feet long and twenty feet wide, were put together on the bank of the river and floated to their position. The cost of the bridge was 7,000,000 rubles, or $5,590,000.

The First Chinese Steamer to Cross the Pacific.

The Chinese steamer Hochung arrived at San Francisco August 30. The report that the Hochung was built in China, and sailed under Chinese command, with Chinese sailors and engineers, was not true. The vessel was built on the Clyde; the captain and three other officers were Danes, and the rest Englishmen. The seamen were mostly Chinese. Nevertheless, the arrival of the Hochung, under the Chinese flag, marks an important date in the history of navigation on the Pacific Ocean, as well as in the history of Chinese commerce.

Business and Personal.

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

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John K. S. Stout, Engineer at Beadleston & Woerz's Empire Brewery, writes to the H. W. Johns Mfg. Co. of this city as follows: "Having used your Asbestos Cement Felting on Boilers, your Single and Double Air Chamber Covering on Steam Pipes, Heaters, and Tanks, and your Special Coverings for Cold Water Tanks and Pipes, I take pleasure in saying that all of them are superior to any other coverings I have ever seen, and are even better than stated by you."

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Clark Rubber Wheels adv. See page 172.

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Fine Gray Iron Castings to order. A. Winterburn, Foundry, 16 DeWitt St., Albany, N. Y.

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For Mill Mach'y & Mill Furnishing, see illus. adv. p. 147.

For Separators, Farm & Vertical Engines, see adv. p. 157.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 157.

For Patent Shapers and Planers, see ills. adv. p. 156.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 157.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

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Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 172.

For Yale Mills and Engines, see page 173.

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For Wood-Working Machinery, see illus. adv. p. 190.

Eclipse Portable Engine. See illustrated adv., p. 189.

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Elevators.—Stokes & Parrish, Phila., Pa. See p. 189.

Penfield (Pulley) Blocks, Lockport, N. Y. See ad. p. 189.

4 to 40 H. P. Steam Engines. See adv. p. 189.

Lightning Screw Plates and Labor-saving Tools, p. 190.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

(1) O. V. D.—In replying to your query as to the proper strength for telephone magnets, in last issue of this paper, an obvious error occurs. The magnet should support three or four times its own weight, instead of three-fourths as there given.

(2) W. H. C. asks: 1. What kind of boiler and fuel should be used in close apartment to run a small engine without vitiating the air? A. You can use a tubular (upright) boiler with gas or alcohol lamps, but you should provide a pipe to carry off the products of combustion. 2. Also what is the best book for a student of mechanical drawing to begin with having no previous considerable knowledge of geometry or mathematics? A. Professor MacCord's drawing lessons in SCIENTIFIC AMERICAN SUPPLEMENT will meet your wants.

(3) W. P. asks if quicklime is a proper disinfectant for a cellar where milk is kept. A. Yes.

(4) W. writes: The exhaust pipe from a 200 horse power steam engine has a back pressure valve in it. The escaping steam, after passing the valve, makes a disagreeable noise. How can this be avoided cheaply? A. The noise will be very much reduced by surrounding the outlet or escape, with a wood pipe, 2 feet or 2½ feet diameter or square, and say 12 to 16 feet in length.

(5) W. H. W. asks: 1. Are not the continuous lines of metallic pipes for gas, water, etc., in city buildings a considerable protection from the injurious effects of lightning? A. Yes, they form an excellent and extensive ground. 2. Do they not render any severe injury to the inmates improbable by affording the electricity a ready escape to the earth? A. It is undoubtedly true that accidents have been averted by the presence of the pipes, and it is also true that the pipes afford so many avenues of escape for the lightning that under certain conditions the danger is increased. For example, suppose a person standing in the path of the lightning between the striking point and the nearest pipe, it is probable that he would be selected as a conductor. 3. Will not a metal roof with water conductors leading to drain afford some protection? A. Yes, to a certain extent, but if several good lightning rods were connected with the roof and well grounded by connecting their lower ends with the gas and water pipes, and by extending them eight or ten feet in a trench made in earth that is continually moist and filled with coke packed around the rod, your protection will be as good as it is possible to secure. 4. Would the risk from lightning be materially increased by placing a wooden pole, with an iron pin on top for a weather vane, two or three feet above a low chimney on a city house with gas and water pipes, metal roof, etc., but without a lightning rod? A. The risk would be increased. All elevated points are sources of danger unless provided with a good rod, well grounded.

(6) T. W. O. asks: 1. Can you give me a process of bleaching animal size, such as is used by paper makers? A. Try a small quantity of alum and sulphite of soda (freshly prepared). 2. What will prevent the forming of rosin size. The size is made of rosin and sal soda. A. A trace of fine sperm or olive oil will probably obviate the difficulty. An excess must be avoided.

(7) "Enterprise" asks: What tools, if any, is a machinist supposed to furnish, at his own expense, when in the employ of other parties? A. All of what are usually termed "hand" tools; but if any are lost or destroyed on the work they are chargeable, also all necessary repairs while used on the work are chargeable.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 24, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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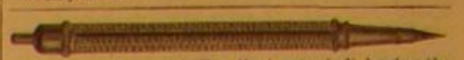

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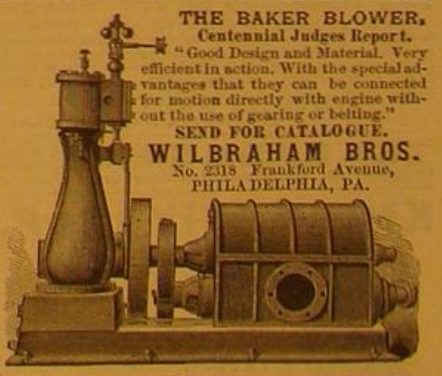

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NEW YORK, SATURDAY, OCTOBER 2, 1880.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 248,

For the Week ending October 2, 1880.

Price 10 cents. For sale by all newsdealers.

POTTERS' MACHINERY—AN OPENING FOR INVENTORS.

Why it is that potters are not inventors, and that the means, methods, and appliances of potters have failed to challenge the ingenuity of men not engaged in that industry, it is hard to say. The fact is manifest, however, that there is no other industry which has been so little benefited by invention during the past two hundred years. The records of the United States Patent Office show less than fifty patents connected with the manufacture of pottery, less than half the number applying to potters' machinery. That the associated potters of the United States are imperfectly aware of the need of inventors in their trade and of the possibility of inaugurating improvements in their industry, is evident from the resolution adopted by them at their recent convention. But the stipulation against patenting which they make in their offers of rewards for invention justifies our use of the word *imperfectly* in describing their sense of need. They offer (1) a reward of five hundred dollars to any person who may invent and submit to them any new and useful machinery of importance and applicability in their art and business; and (2) a reward of two hundred and fifty dollars to any person who may invent any essential and useful improvement to or upon any machinery now in use by potters, "provided that these inventions or improvements are free from all patents obtained or to be obtained from the inventor or any other person."

The meaning of this provision is not so clear as it might be. Still it is evident that the United States Potters' Association require an absolute surrender by the inventor of any property rights in his invention before the offered prize is awarded. From this it is safe to infer one of two things: either the associated potters do not believe that an invention of essential use in their industry could be worth more than five hundred dollars; or that an inventor capable of producing new and useful machinery, applicable in an art substantially unimproved for two hundred years, yet employing millions of capital, is likely to hold his labor and his property rights at a curiously low figure. In either case we are inclined to think that the association might be benefited by a careful study on the part of its members of the influence of patented inventions upon the progress of other arts, and of the value of such inventions both to the manufacturers who use them and to their patentees.

Speaking of the premiums offered, the *Pottery and Glassware Reporter* remarks that "whatever causes may be to blame for it, it is an established fact that pottery is behind the age in the matter of labor-saving machinery, the same hand processes being now employed as were in vogue thousands of years ago. While every other industry has benefited largely by the inventive genius of modern times, the potter plods on in much the same way as did his forefathers in the art. This state of affairs is largely due, probably, to the conservatism of the potters themselves, who seem very generally to go on the principle that 'what was good enough for their fathers is good enough for them,' and partly to the fact that the attention of inventors has never been publicly called to the needs of the industry in this regard. Once let it become known among inventors that machinery of improved form is needed, and from all the devices likely to be offered something can certainly be selected to suit the different purposes."

Though the anti-patent stipulation is likely to prevent any eager competition for the prizes referred to, the offer of them may be beneficial in calling the attention of inventors to the field so long left fallow. The pottery business is rapidly increasing in importance in this country, and any invention calculated to improve, facilitate, or cheapen the process of manufacturing cannot fail to become a valuable property.

The associated potters appointed Messrs. Thomas C. Smith, Greenpoint, N. Y., John Moses, Trenton, N. J., and M. Tempest, Cincinnati, Ohio, a committee to investigate and test any inventions that may be offered, and to award the prizes. To them all communications relating to the matter should be addressed.

BURNING OF A SUPPOSED FIREPROOF BUILDING.

In the recent burning of the Manhattan Market, one of the most conspicuous and costly buildings in New York, we have another illustration of the fatal mistake of putting into a would-be fireproof building just enough wood to cause its destruction.

In this case the blunder was not so apparent as the common one of setting a wooden spire over a stone church, or a tinder box, in the shape of a mansard roof, over a granite warehouse; yet the blunder was there, and the ruin of a building which cost $1,400,000 is the result.

The building was considered practically if not absolutely fireproof. The floor was of concrete, the walls were of brick and glass, the rafters were iron trusses, and the roof was covered with slate. The stall fixtures were of wood; but the stalls were so widely spaced that there would have been no great danger of injury to the main building through their burning, even when re-enforced by the pile of empty barrels in which the fire began, had the roof been constructed as it should have been in a building of that character. Unfortunately the vast and lofty arch of the roof was lined with wood for convenience in fastening the slates, and, though the quantity of wood was relatively small, it was large enough to insure the destruction of the building, otherwise fireproof against fire.

The building was erected in 1871, and occupied the block bounded by Thirty-fourth and Thirty-fifth streets, and Eleventh and Twelfth avenues. It was 800 feet long, 200 feet deep, 80 feet high in the interior, and was surmounted by a lofty clock tower. The building, with the land and foundations, cost about $2,000,000. The loss by the fire exceeded $900,000.

CONSCIENTIOUS WORKERS.

The tendency of our times is to disregard old maxims. It is true, many of them, based on the experience of other people under very different conditions, are not applicable in our day. "Haste makes waste" may be true in the workshop, but the business man knows that "time is money," and it pays to be in a hurry when the market shows signs of a change.

The good old maxim that "whatever is worth doing is worth doing well," is too often forgotten. "That is good enough for him, or for the money," is a poor excuse for a man to sacrifice his good name, and still worse to induce him to acquire careless habits. It has been said that while American workmen are better paid, better fed, better educated, and, we may add, better behaved, than those of any other country, they can beat the world in slighting their work and cheating their customers and employers. The shoemaker, who turns out one or two pairs of boots a week for a customer, takes an honest pride in his work, and feels and knows that he is to be held personally responsible for every stitch he puts in. In a large factory, where the division of labor should make every man an expert in his own branch, the workman often loses his identity and responsibility. He knows the customer cannot fall back on him, however imperfect his work. If it is only covered up so as to conceal it from the eye of his foreman he is safe. Probably this is doing much to encourage careless work. It is well known that ready-made clothing, boots, dresses, underclothing, everything made in large quantities, is far cheaper than custom work, but alas! it is very often not as good.

There are many people in every land who like to be humbugged, while others have an equally strong passion for cheap wares, whether poor or good, and some one must supply this demand. The producers of such goods employ poor workmen at correspondingly poor wages, because they must make their profits out of their workmen. Five and ten cent stores are lowering the standard of production as well as the scale of wages.

It never pays to be a poor workman. If you are a young man, aim to do honest work, and, although your present employer may not be willing to pay you any more for a well-made coat or a neatly-finished boot than he would for a botch, don't be discouraged. If you are a carpenter, make the best joint you can; if you are a machinist, see that every bolt and rivet is as firm as if your life depended on its properly fulfilling its duties. How carefully the aeronaut examines his balloon, the tight rope performer his rope before he trusts his life to it. Would a shipbuilder take passage on a vessel of his own building if he knew that he had willfully neglected or slighted any essential part of her hull? Yet many a young mechanic has destroyed his own future and committed moral suicide by sending forth a poor piece of work. The old surgical professor's caution to a young medical student is not inapt here. Said he, "If you are ever called to set a broken leg, and your work is a failure, and the man becomes a cripple, you may be sure he will always come limping along just at the wrong time, when you are surrounded by your clients and friends. He is a walking advertisement of your incapacity."

Every manufacturer knows the value of a good reputation. There are names that will sell almost anything. Why do Burt's shoes bring a better price than those of other makers? Why does Squibb's ether bring a higher price than that of any one else? Why do Merk's chemicals have their own price list? Because they are known to be honestly prepared.

The path to fame by honest merit is a slow and tedious one. A manufacturer who is so careful about his products that he has to put a higher price on them than his less conscientious neighbor can sell for, may be repaid at first by small sales and smaller profits. It takes a long time to build up a reputation by excellence, but once acquired it is like the pearl of great price.

It is much the same with the workman as with the manufacturer. If every stroke he strikes is solid work, conscientiously performed, he will acquire a reputation, limited as it may be, that is sure to pay in the end. We would not conceal or deny the fact that some men labor under peculiar disadvantages. All men are not born equal, either mentally or physically. One is naturally skillful in one direction, another is expert in many things. One man may do his level best, and yet he will not turn out as good a piece of work as his more skillful brother who only half tries. Let him not be discouraged because he is handicapped in the race, and may not be able to reach the top of the ladder. There is room for honest workmen everywhere; even respectable mediocrity pays better than brilliancy coupled with trickery.

The native American is distinguished by his ingenuity, and with half a chance he makes his mark everywhere. Yet he sometimes loses the race in competition with less able men of other lands, because their careful training and early drill in their profession, their long and severe apprenticeship, has more then compensated for the want of natural tact and ingenuity.

Perseverance will not conquer all things, but it goes a long way toward success. While luck seems to favor the

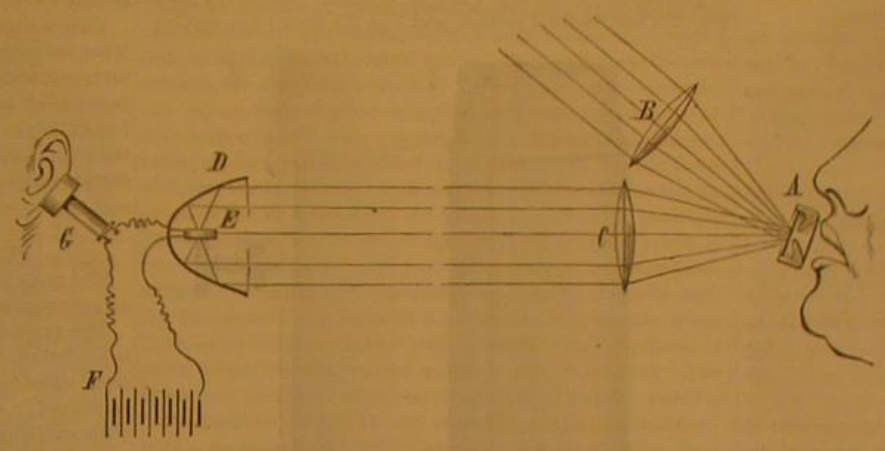
few, most men have to carve out their own success by hard labor, in which a full determination to do everything to the very best of one's ability counts for more than is generally supposed. Above all things, don't waste time in regretting that another trade was not chosen. If it is an honest one, stick to it and it will pay.

THE PHOTOPHONE.

As the remarkable series of investigations in relation to sound transmission by light, which led to the invention of the photophone by Professor Bell, have already been described at length in the SCIENTIFIC AMERICAN (page 176, current volume), and in the SUPPLEMENT (No. 246), only a brief reference to the fundamental principles of the invention will be needed to make clear the annexed diagram, which illustrates the manner in which articulate speech is transmitted by means of a beam of light, without any visible or tangible connection between the transmitting and receiving stations.

A beam of light from any source is concentrated on the diaphragm, A, by the lens, B, and the diaphragm, which is capable of reflecting the light, is placed in such a position in relation to the lens, B, as to project the light along a line joining the axes of the lens, C, and the parabolic reflector, D. The lens, C, renders the divergent rays of light parallel, and the parabolic reflector concentrates the light upon the selenium cell, E.

The selenium forms a part of an electrical circuit, which includes the battery, F, and receiving telephone, G. A sound made in the vicinity of the transmitting instrument vibrates the diaphragm, A, and undulates the beam of light projected through the lens, C, and the consequent variations in the intensity of the light concentrated on the selenium by the parabolic reflector changes the electrical conductivity of the selenium and renders the electric current undulatory. This current affects the receiving telephone in the same way as it would be affected in an ordinary telephonic circuit, and the sounds made in the transmitting instrument are reproduced in the telephone.



BELL'S PHOTOPHONE.

We have described but a single form of apparatus, as the principle is substantially the same in all the forms made known to the public. Professor Bell, in his recent lecture before the American Society for the Advancement of Science, said that about fifty different forms of apparatus had been devised. The distance through which the "photophone" will work successfully has not yet been determined, but it is believed that the extreme will be limited only by the difficulty of adjusting the instruments at widely separated stations.

In the course of his experiments with a perforated disk interrupter, Professor Bell sought to ascertain the nature of the rays that affect selenium. For this purpose he placed in the path of an intermittent beam various absorbing substances. When a solution of alum, or bisulphide of carbon, is employed, the loudness of the sound produced by the intermittent beam is very slightly diminished; but a solution of iodine in bisulphide of carbon cuts off most, but not all, of the audible effect. Even an apparently opaque sheet of hard rubber does not entirely do this. When the sheet of hard rubber was held near the disk interrupter, the rotation of the disk interrupted what was then an invisible beam, which passed over a space of about twelve feet before it reached the lens which finally concentrated it upon the selenium cell. A faint but perfectly perceptible musical tone was heard from the telephone connected with the selenium. This could be interrupted at will by placing the hand in the path of the invisible beam. It would be premature, says Professor Bell, without further experiments, to speculate too much concerning the nature of these invisible rays; but it is difficult to believe that they can be bent rays, as the effect is produced through two sheets of hard rubber containing between them a saturated solution of alum. Although effects are produced as above shown by forms of radiant energy which are invisible, the apparatus for the production and reproduction of sound in this way has been named the "*photophone*," because an ordinary beam of light contains the rays which are operative.

Arrival Home of the Anthracite.

The little steamer Anthracite, worked on the Perkins high pressure system, arrived at Falmouth, England, on the 14th of September, having made the voyage from Philadelphia in twenty-three days. She had on board at starting twenty-five tons of coal. Having thus twice crossed the Atlantic successfully, this vessel seems to have well demonstrated the practical value of the new system. The reports of the machinery trials of this steamer, which took place a few weeks ago at the United States Navy Yard, Brooklyn, have not yet been made public.

Phosphorescent Lighting.

Dr. Phipson takes sulphide of barium, or some other substance which is rendered phosphorescent by the solar rays, and incloses it in a Geissler tube, through which he passes a constant electric current of a feeble but regular intensity. He claims to obtain in this manner a uniform and agreeable light, at a cost lower than that of gas.—*Les Mondes.*

THE SOCIAL SCIENCE ASSOCIATION.

The annual meeting of the American Social Science Association began in Saratoga, N. Y., Sept. 8. The papers read related chiefly to education and sanitary affairs. The report of the Committee on Casualties in Mining, read by Mr. J. D. Weeks, of Pittsburg, showed that "in Pennsylvania, one man was killed last year for each 105,700 tons of anthracite raised, a greater mortality than obtained in English mines. In Ohio the figures, confessedly imperfect, give one death to 142,253 tons of coal raised in 1874, and in 1878, one death to 255,000 tons raised. While some accidents are unavoidable, there is no doubt that a great majority of explosions come from the carelessness of miners, who will not hesitate to open a safety-lamp surrounded by fire damp to light a pipe. The peril from the falling of roofing and slate is greater, however, than any other, being about 40 per cent. of the total; and of these the public hears the least because they are so common. These are too often the result of forgetfulness, rashness, or neglect. And again, employes are more at fault than employers. In fact, carelessness and neglect are common among miners to a degree which seems scarcely possible.

A report on Kindergarten schools by W. T. Harris, of St. Louis, recognized very clearly the advantages of positive, playful, and social training for children, and as clearly the defects and dangers of the Kindergarten system as developed by Froebel and carried out in this country. The characteristic differences between American and German children, from geographical and social causes, were well insisted upon, but no reference was made to the narrow range and purely artificial cast of Froebel's mind as exemplified in the matter and method of his teaching. His spirit was true and admirable, but his system rigidly applied is anything but suitable for American children.

Education in England, particularly as developed for girls and women, was treated by Miss E. J. Simcox, of the London School Board, and the co-education of the sexes was afterward discussed with some feeling. Another aspect of education was considered by President J. M. Gregory, of the Illinois State University, in a paper on American newspapers. Mr. Gregory took a generous and hopeful view of the influence of newspapers, regarding them as the best index of American life and the fairest representation of the people. The best brain of the country speaks through the newspapers. They are the people's libraries—the cyclopedia of the millions.

The sanitary renovation and salvation of Memphis was discussed by Dr. A. F. Lincoln, of the National Board of Health. The regulation of medical practice by statute law was considered by Dr. E. W. Cushing, of Boston; and the economic aspects of the treatment of the insane, by Dr. Walter Channing, of the same city.

The question of adulteration of foods, medicines, etc., was brought prominently before the meeting by Mr. George T. Angell, whose sweeping assertions were disputed by Professor S. W. Johnson, of New Haven, Professor Remsen, of Baltimore, Professor Nichols, of Boston, and others. Secretary Sanborn, on the contrary, stood up for Mr. Angell, rating the negative testimony of those who had not been able to discover many or frequent adulterations as of less weight than that of men who had found such adulterations.

The proceedings of the second day's meeting embraced the reading of the following papers: "The Socialist Laws of Germany," by H. W. Farnham; "Modern Legislation Touching Marital Rights," by Henry Hitchcock; "Libel and its Legal Remedy," by E. L. Godkin; "Pensions in a Republic," by F. J. Kingsbury; "Laws Regarding Dissection and Grave Robbery," by Edward M. Hartwell; and "Indeterminate Sentences for Crime," by Z. R. Brockway, Superintendent of the Elmira Reformatory.

In the first paper and the third and last day, Rev. D. O. Kellogg read a paper on "The Principle and Advantage of Association in Charities." In the subsequent discussion Robert T. Paine maintained that charity must do four things—relieve worthy need promptly, fittingly, and tenderly; prevent unwise alms to the unworthy; raise into independence every needy person, where this is possible, and make sure that no children grow up to be paupers. Relief, detection, elevation, and prevention are all essential parts of a complete plan. Families or persons who have fallen into want usually need, first, relief—food if hungry, fuel if cold, clothing if naked; second, a long, steady, patient pull by a wise, strong hand up into solid land. This is the work in which the associated charities ask cordial co-operation. Almsgiving, which saps manhood, self-respect, and self-reliance, is a curse. "The Care and Saving of Neglected Children" was considered by Miss Hollowell, and the "Volunteer System of Charity," by Mrs. F. B. Lockwood. Mr. G. B. Bartlett submitted a paper on "The Recreations of the People," in which he attributed most of the recent improvement in the physical health and strength of our people to the increase in holidays and the attention given to athletic sports. Mrs. Julia Ward Howe contributed a paper on "The Changes in American Society;" and Frederick Law Olmstead one on "Public Parks," in which he called attention to the fact that twenty-five years ago we had no parks which might not better have been called something else than a park, whether so designated or not. Since then a class of works so-called has been undertaken which to begin with are at least spacious and have possibilities of parklike qualities. On twenty of these now in progress over $40,000,000 have been expended—well nigh $50,000,000—and this does not tell the whole cost. Considering that in the towns making this outlay the necessity of a park was little felt, it manifests a remarkable progress of public demand. While in the first half of the century only one public park was laid out in Europe, since 1850 as many parks have been laid out in the large towns of Europe as with us, and the area has been larger there. What has been secured for London alone is of greater extent than all the town parks of America together. The next meeting of the Association will be held in Saratoga in September, 1881. The officers for the year are:

President—Francis Wayland, Yale College.

Vice Presidents—Benjamin Pierce, Cambridge, Mass.; Theodore D. Wolsey, New Haven; Martin B. Anderson, Rochester; Mrs. Caroline H. Dall, District of Columbia; Thomas C. Amory, Boston; Henry B. Baker, Lansing, Mich.; Thomas M. Post, St. Louis; J. W. Hoyt, Cheyenne; Rufus King, Cincinnati; W. H. Ruffner, Richmond; W. L. Trenholm, Charleston; Isaac Sherman, New York; Henry Villard, New York; Maria Mitchell, Poughkeepsie; Nathan Allen, Lowell; Mrs. J. E. Lodge, Boston.

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Department of Education—W. T. Harris, Concord, Mass., chairman; Emily Tarbott, Boston, secretary.

Health Department—D. F. Lincoln, Boston, chairman; E. W. Cushing, Boston, secretary.

Finance Department—David A. Wells, Connecticut, chairman; Hamilton A. Hill, Poston, secretary.

Department of Social Economy—W. B. Rogers, Boston, chairman; Walter Channing, Boston, secretary.

Department of Jurisprudence—Francis Wayland, New Haven, chairman; Theodore J. Woolsey, New Haven, secretary; corresponding members, Moncure D. Conway and Edith Simcox, England.

The Course of a Lightning Flash.

Prof. Tait, of Edinburgh, insists that when people think they see a lightning flash go upward or downward they must be mistaken. The duration of a lightning flash is less than the millionth part of a second, and the eye cannot possibly follow movements of such extraordinary rapidity. The origin of the mistake seems, he says, to be a subjective one, viz., that the central parts of the retina are more sensitive, by practice, than the rest, and therefore that the portion of the flash which is seen directly affects the brain sooner than the rest. Hence a spectator looking toward either end of a flash very naturally fancies that end to be its starting point.

Shades for Electric Lights.

A French inventor, M. Clémandot, has devised a shade for reducing the glare of electric lights, which he claims to be much more economical than ground glass globes. He makes his lantern of glass tubes filled with finely spun glass threads or glass wool. By reflection from the glass threads the light is given the desired diffusion, with a loss of illuminating power not exceeding 15 per cent, against 30 or 40 per cent with opal or ground glass. The natural blueness of the electric light can be corrected by tinting the glass tubes or the inclosed wool.

Loss of Melbourne Exhibits.

By the wreck of the ship Eric the Red, on the southwest coast of Australia, 150 cases of goods for the American exhibit at the Melbourne World's Fair were lost. As the Exhibition opens October 1, the exhibits cannot be replaced.

THE locomotive of the train that was wrecked in the Tay Bridge disaster has been fished up and repaired, and is now drawing trains on the Edinburgh and Glasgow line.

NEW INVENTIONS.

An improvement in fireproof ceilings has been patented by Mr. John D. Ottiwell, of New York City. The object of this invention is to prevent the plastering applied to the ceilings at the points where the corrugated arched plates meet the girders from becoming loosened and falling off.

A shoe nail for the channels of boots or shoes roughened on its shanks, having a body slightly tapered on two of its opposite sides, but drawn from the middle of the other two opposite sides to form an entering point, and provided with an elongated or diamond-shaped head, has been patented by Mr. John Hyslop, Jr., of Abington, Mass.

Mr. Julius Austin, of Wakeman, Ohio, has patented a simple, inexpensive, and effective wind wheel, to be operated by the wind for actuating pumping, grinding, and other machinery.

An improvement in refrigerators has been patented by Mr. Charles P. Jackson, of Chicago, Ill. The object of the invention is to secure economy and convenience in shipping and storing refrigerators, and to secure a constant circulation of air and an extended refrigerating or cooling surface within them.

Mr. Charles L. Norton, of New York City, has patented an improved spring clip for indexing books, which is both simple and convenient. It consists in a clip of spring metal with sides of unequal length, and having a sharp bend near the end, and an index letter stamped on the part between the bend and the end of the clip, so that the clip can be placed on the end of a page with the lettered part projecting outward, and thus indicating the index divisions of the book.

An improved neck yoke, for connection with the end of the tongue or pole in a double team, has been patented by Mr. Thomas N. Rudgers, of Fowler, Mich. It consists in the peculiar means for increasing or diminishing the leverage of the neck yoke, or adapting it to unequally matched horses.

Mr. Alfred Nobel, of Paris, France, has patented a primer for the ordinary composition of powder when reduced to meal, and thereby adapted to increase the charge in a hole of given size by its compressibility.

A fence, so constructed that it can be readily set up, and which is light, strong, and durable, and not liable to be blown down or pushed out of place, has been patented by Mr. Daniel T. Hazen, of East Milan, Mich.

A register for registering the number of fares deposited in the fare boxes used in street railway cars, stages, and for other purposes, has been patented by Mr. Joseph N. Hardy, of New Orleans, La. The invention consists of a toothed cylinder pivoted in the lower part of the fare box below the tilting trap. The shaft of this toothed cylinder is connected with an index on a circular dial, so that as the cylinder revolves it turns the index, which shows on the dial the number of fares paid.

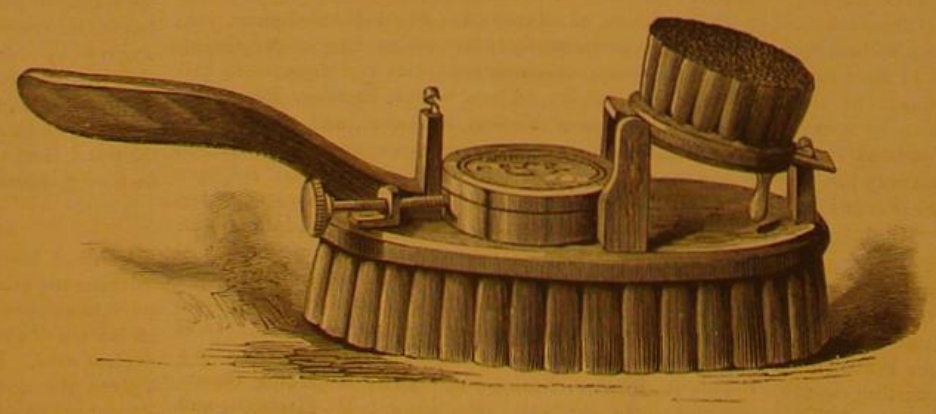
Mr. Bernhard von Schenk, of Heidelberg, Germany, has patented a mass for manufacturing plastic objects, consisting of sulphate of lime nine and a half parts, coal or coke one part, and iron shales sixty-hundredths of a part.

Mr. William Wilmington, of Toledo, O., has patented certain improvements in that class of car wheel chills which have in the outer portion of the flange face a peripheral receptacle for sand or its equivalent. The invention consists in constructing the chill with this peripheral receptacle, and also with a circular chamber in rear of it having an inlet and outlet for the circulation of superheated steam, the object of which is to retard the cooling of the iron in order to increase the depth of the chill.

IMPROVED BLACKING BRUSH.

The engraving represents a novel blacking brush recently patented by Mr. E. L. Wood, and now being introduced by Messrs. E. L. Wood & Co., of Eastland City, Eastland county, Texas. The improvement consists in hinging the dauber or small circular brush by means of which the moist blacking is applied, so that it may swing over and become charged with the blacking contained in an ordinary blacking box clamped on the back of the polishing brush. The blacking box is secured in its place by a thumbscrew. The dauber is pivoted and provided with a crank at the back of its support so that when it is inverted so as to touch the blacking it may be rotated. Spring catches are provided which hold the dauber in either of its positions.

When the brush is not in use the cover is placed on the blacking box and the dauber is brought down upon it. Arranged in this way the brush may be carried without blacking other articles with which it may be brought into contact.



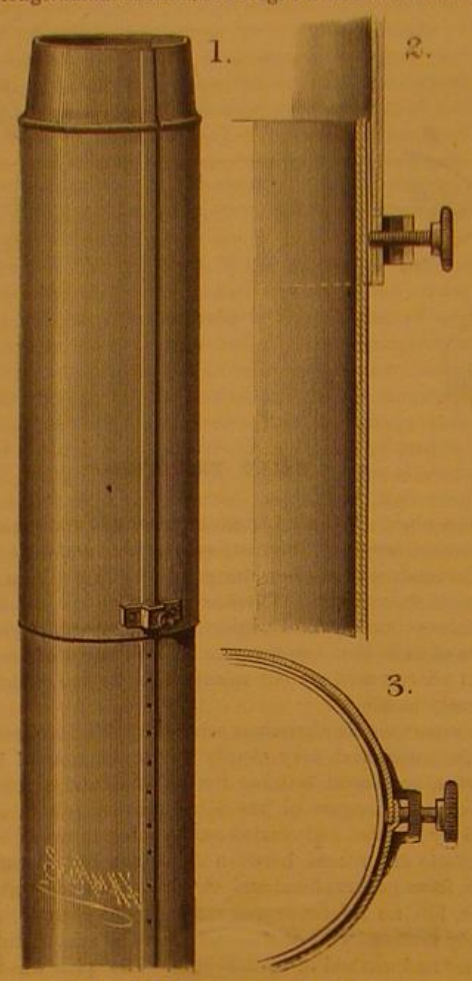
NOVEL BLACKING BRUSH.

Importing Oysters.

Boston flats have recently been stocked with oysters unintentionally introduced from African waters by the bark Fantee. While the bark was off the coast of Africa her sides and bottom were fastened upon by oyster spat, which throve abundantly. Many bushels were removed on her recent arrival at Long Wharf and planted on the flats. It is hardly probable that they will survive the cold of the coming winter.

NEW EXTENSION STOVEPIPE.

The engraving represents an improved extension stovepipe joint recently patented by Henry Cook, corner of Main and Harrison streets, Leadville, Col. The two parts are adapted to slide together telescopically, admitting of using the pipe in situations where joints of the regular length would not be available. The advantage of this arrangement will be apparent to any one having anything to do with stoves and stovepipes, and the amount of vexation that will be avoided by its use is considerable. The construction of the extension joint will be understood by reference to the engraving, in which Fig. 1 is a perspective view of the joint, Fig. 2 a longitudinal section, and Fig. 3 a transverse section.



COOK'S EXTENSION STOVEPIPE.

The invention consists in a joint of stovepipe made in two parts, one sliding within the other. A thumbscrew passes through a yoke attached to the outer part, and enters any one of several indentations in the rib or seam of the other part. It will be seen that this length may be used in the same way as other pipe, and it may be readily lengthened or shortened to suit circumstances.

Further information may be obtained by addressing the inventor as above.

Solar Boiler.

In a note before the Academy of Science, in Paris, Mr. A. Pifre describes a compound reflector having a focal length much less than usual. The zone of maximum heat is nearest to the lower part of the boiler, and the laws of the heating can be easily studied. The reflector presents a usable surface of about 100 square feet to the sun. The boiler contains 1·8 cubic feet of water. When the sky is clear the water boils in about 40 minutes, and the pressure rises 1 atmosphere every 7 or 8 minutes. In several experiments even 6 minutes have been sufficient to raise the pressure 1 atmosphere. The machine connected with the apparatus has a new construction, and a pump connected with it lifted per minute 3½ square feet of water to a height of 10 feet. This labor is ten times as great as that previously obtained at Algiers.

Roman Coins at Harvard.

In 1877, Robert Noxon Toppan (1858), of New York, presented to the library a collection of Roman coins, eighty-one in number, illustrating the period from 400 B.C. to Constantine the Great, A.D. 337. The coins, says the *Harvard Register*, are of copper, silver, and gold, and are of exceptional value, owing to their fine state of preservation, many of them being as clear cut as the recent coinage of the United States Mint. Copper money was first coined in Rome about 425 B.C., and this collection includes a large copper *as* of 400 B.C. The stamp of the government did not determine the value of the coin; it simply certified that the value existed in the coin. All the Roman emperors before Constantine are represented here. Cleopatra, Julius Cæsar, Brutus, Sylla, the Calpurnian, Æmilian, and Acilian families, contribute a coin each, and there are ten of the year 269 B.C.

This collection remained unarranged until quite recently, when the donor presented a handsome case, and personally arranged the coins chronologically, with a descriptive label beneath each coin. The case is of polished rosewood, two feet in height, three feet in length, eighteen inches in depth at the base, and six inches at the top. It has been placed in the art room, which is immediately above the delivery room, and can be seen at any time by permission of the librarian.

How Diamond Mines are Worked.

The system of working the diamond mines is described by an operator as follows:

The ground being picked loose by natives and broken up, is hauled out of the mines in tubs running on inclined wires; from these tubs it is transferred to a sifting cylinder, which removes the coarser stones, the remaining soil being mixed with water and slowly stirred in a flat pan of circular form, by means of arms fitted with teeth, this pan varying from 6 to 15 feet in diameter, according to the amount of work to be done. The effect of this is to leave the diamonds, which are heaviest, at the bottom; the lighter soil escaping over the edge of the pan, to be taken up by a dredger and trucked away. At the end of a day's work the contents of the circular pan are cleaned out and washed up in hand-sieves, when in turning over the sieve on the table the diamonds can be at once seen from their brilliance, some being of most perfect octahedron shape and as clear as crystal.

The rough diamonds are almost invariably below 10 carats in weight, the average being about the size of a pea; indeed, in the Bultfontein mine, a 10 carat stone is looked upon as a curiosity, though specimens exceeding 100 carats in weight have on rare occasions been secured. The value of a stone depends entirely on its color, shape, and freedom from spots or flaws; those of faultless shape and perfect whiteness taking the precedence of all others. The diamonds exceeding 20 carats in weight are mostly of various shades of yellow, a large white diamond being a comparative rarity.

A Good Example.

A shipbuilding firm of Dumbarton, Scotland, offers awards ranging between $10 and $50, to any workman in their employment who has (1) invented or introduced a new machine or hand tool into the yard; (2) improved any existing machine or hand tool; (3) applied any existing machine or hand tool to a new class of work; (4) discovered or introduced any new method of carrying on or arranging work; or (5) made any change by which the work of the yard is rendered either superior in quality or more economical in cost.

Into the Bonanza Group.

The north header of the Sutro Tunnel has passed through the Consolidated Virginia and California mines, and is fast nearing the point where it will connect with the Ophir, being at present in the Golden Gate ground, which adjoins the Ophir and Mexican on the east. The course of the tunnel will continue a little east of north until it connects with the Ophir, when it will bear more to the eastward for a connection with the Union shaft, thus passing diagonally through the Golden Gate ground at a depth of 1,600 feet below the surface. Its connection with the Union shaft will be a very important one and anxiously looked for, as it will be of invaluable assistance in the way of drainage to the new bonanza deposits now being developed in the Sierra Nevada and Union ground.

It is easy to see that the Golden Gate, located in the very midst of these valuable developments, and with the Sutro Tunnel now making its way directly through it, is rather of an interesting piece of property at the present time, as the tunnel has over a thousand feet yet to go in order to reach the Union shaft, and all the way through the Golden Gate ground, passing directly beneath the heavy and prominent croppings in the cemetery, just north of Virginia. The Golden Gate Company, formerly the old Vermont Consolidated, have their title fully perfected and covered by United States patent. They now propose to resume sinking their large new three-compartment working shaft down to a connection with the tunnel, and have levied an assessment for that purpose. They have excellent prospects already, but are going after their full share of the good things at that point.—*Enterprise.*

AMERICAN INDUSTRIES.—No. 56.

BOOK-MAKING—THE AMERICAN BOOK EXCHANGE.

Most people have heard the story, in one way or another, of the old lady who dropped into a bookstore one morning to have her old Bible reprinted, as she was advancing in years and wanted to get one in which the type was larger; how the obliging clerk took her order, and in the afternoon of the same day furnished her with a book having just the size of print and description of binding she required, and with which she was delighted as a faithful reproduction of

her cherished volume. Probably there are not many at this day who believe that books are made *de novo* with such expedition; but the business of modern publishing houses requires the help of so many essentially different industries, and the division of labor is so carried into a hundred details, that comparatively few, except those who have made a specialty thereof, have any adequate idea of the several processes and the number of different hands which the work goes through in making a printed book. We have, therefore, taken as the subject of our industrial sketch this week the leading departments of this business, as carried on by the "American Book Exchange," the style of a company which has, within less than two years, become one of the largest publishers of standard books in the United States.

The business was inaugurated by the publication of one volume in January, 1879. It was started on the idea that the demand for standard books would be practically almost unlimited, if their price could be so reduced as to bring them within the reach of the masses. To be able to make large reductions in the price, it was imperative that extraordinary editions should be printed, as well as that their manufacture should be conducted according to the strictest business principles. Of a great proportion of the books printed such small editions are usually sold that the expense of the preparation of the plates, with even a moderate margin of profit to the publisher, makes the proportionate cost of each volume very high as compared with what it would be were the books sold by the hundred thousand. Starting with these facts, and with the determination to issue only such books as would be universally acknowledged as standard, the originators of this enterprise have already achieved a success so decided that, in looking over the work they are now doing, it seems no exaggeration when they claim to have effected a

"literary revolution," for, although the business has been so recently established, they are now actually printing and selling over 5,000 books a day, nearly all of them being works such as no well selected library would be without, and the selling price being from one-fourth to one-tenth only of what the same books could previously have been bought for.

The initial work in the making of a book, after the "copy" is ready, is the composing or arranging of the types. This, in all books which do not contain elaborate engravings, or of which only small editions are printed, constitutes a main portion of the cost of manufacture. It is a branch of the business, however, in which it has been found very difficult to reduce the expense, as, notwithstanding all the efforts made by inventors in different parts of the world for more than fifty years past to perfect a machine for type-setting, it is only within a brief period that a successful working machine has been contrived, which, on plain work, will do the composition of a book at a lower price than the same can be done by hand. Such a machine, an illustration of which occupies the central position on the first page, has been at work in the "Gray" printing office, in New York, for two years past, and a great deal of the composition required by the American Book Exchange has been done thereon. There are twenty of these machines in this establishment, and the cost of type-setting thereby is reduced nearly 50 per cent as compared with hand work. The machines are only suitable for plain work, such as history, biography, travels, etc., where but one kind of type is used throughout, and the text is free from italics, quotations from foreign languages, tables of figures, etc. The type is compactly held in three different metallic cases, with separate grooves for the supply of each letter, the letters all lying in the same position. These cases are at the top of the machine, and the operator sits in front of a keyboard just below; a touch on any one of the keys releases the particular letter or character desired, the bottom one in its special compartment of the case, when it drops by its own gravity into a channel that conducts it to its proper position in the matter being composed. The types are thus set up in one long line, which is steadily pushed out to the left of the operator, where a "justifier" with a measure cuts it off in lengths sufficient to make lines of the width of the page of a book or newspaper column, as may be desired.

The distribution of the type, or putting them back in regular order in the cases after the printing has been done or a plate made, is performed by a separate machine, which works automatically and very rapidly, needing only a boy to tend

it. Each different letter or character has one or more nicks on the body of the type, so arranged as to be unlike the nicks on any other letter, and the distributing machine places each type in its proper place according to these nicks. An expert operator with one of these machines can compose from 45,000 to 55,000 ems of type in a day of ten hours, while good compositors will hardly average the composition and distribution of 7,000 ems each in the same time. Including the justification and distribution, the extra correction which a machine calls for, and the occasional attention of a machinist, the cost of composition comes to something less than 20 cents per 1,000 ems.

There will always, however, be a great amount of work which, from the variety of characters employed, or the style of the text, must be done by hand, and the "Library of Universal Knowledge," now in course of publication, is of this description. It will be a verbatim reprint of the latest London edition of "Chambers's Encyclopædia," with additions by American editors, covering some 15,000 separate topics, making one of the largest works of this class ever issued. It will make fifteen volumes, octavo, of nearly 1,000 pages each, closely printed type. Two volumes are to be issued monthly. S. W. Green's Son, a Beekman street printer, having contracted to do the composition of seventy pages a day regularly—an amount of work of this character which but few of our large printing offices would undertake to accomplish.

It is very rare that a book is now printed directly from the types, but a mould is taken from the type form, from which a plate is made to print from. An illustration on this page shows a large press in which the type form is placed to make this mould, the face of the type being carefully brushed with black lead, and the impression being made in wax, which is spread about a sixteenth of an inch thick on a metal backing. This wax mould is suspended in a solution of sulphate of copper, sulphuric acid, and water, and connection being made with an electric machine, the copper is deposited in the mould to represent exactly the impression left in the type by the wax, the finest lines of the most delicate engraving being clearly and sharply brought out. It takes about three hours' time for the deposit of sufficient copper to make a plate which will wear well, and when this is accomplished type metal is cast upon the back of the thin sheet of copper to form a solid backing. The plates are now carefully planed down on their backs to a uniform regular thickness, trimmed on the edges, and, where the letterpress would show a good deal of white paper in printing, some of the extra metal is cut or "routed" out. The electrotyping for these publica-

tions is done at the establishment of Lovejoy & Son, who have for several years made the electrotype plates from which the SCIENTIFIC AMERICAN is printed.

The types being set and the plates made, the form is now ready to "go to press," as printers term it, and one of the illustrations at the top of the first page represents the printing process. The work of the Book Exchange has so quickly grown to such great dimensions that it has been difficult to engage a sufficient number of the kind of presses desired to do the work. The Adams press does the greater part of the printing, over fifty presses being kept constantly at work, and fifteen of these working through twenty-four hours a day. The Adams press is an old style book press, which does not work quite as rapidly as some presses of more recent design, but it has a thorough ink distribution, gives a firm, clear, and even impression, and has always been a favorite with printers for work which was to be done with great care. There are other presses which it is claimed will do as good printing, but it is not pretended that any of them will do better book work than the Adams press.

The sheets are now ready for binding, leading details of which are represented in the other illustrations on the first page. The printing is usually done in large forms, with 16, 24, 32, 36, or 48 pages on one side of a sheet, each sheet being styled a signature, and so marked at the bottom of the first page of such signature, that, when the binder places the signatures in consecutive order, the pages of the book will all come in their proper places. The binding is all done in establishments expressly fitted up for this purpose at 18 Spruce street, 26 Beekman street, 33 and 35 Vesey street, and 8 Church street, where also are the packing and shipping departments of the business. Representations of these several buildings will be found on this page. More than 5,000 books

are now being bound daily in cloth and half Russia at these binderies, and new machinery is being put in, which, with the additional help that can be employed, is intended to double this capacity. The number of hands now engaged in this department averages 75 men and 140 women and girls.

The folding of some of the work is done by hand, while a large portion is done on folding machines, of which there

are six in constant operation. The machine will fold the sheets about as fast as a feeder can supply them. The sheet is laid by points, so that the printed matter in each page will come in just the same relative position with that in all the other pages, when a long, light strip of metal, held by curved arms, comes down and forces it through a narrow opening in the table-like top of the machine, whence it is taken through a series of tapes and rollers arranged so as to give just the folds required.

After the folding comes the "gathering," or the putting together of the different sheets which make a book. The manner in which this is done will be readily understood from the illustration, in which the employee is seen surrounded by piles of sheets, taking one from each pile successively until all the signatures of a book are held together in the hand.

As may be supposed, in the rapidity with which the folding and gathering are performed the sheets are not pressed firmly and solidly together as they appear in a bound book but to effect this they are put in a powerful press, called the "smasher," which instantly squeezes them so tight that the book will then be almost as hard as a board, and only an outside leaf or so in a pile of several thousand will be loose. In this state they are taken to a machine where two or three or more shallow cuts are sawed across the backs, just sufficient to allow room for a strong cord to pass through.

In the sewing, the books as gathered are placed in piles from 12 to 18 inches high, and these cords are arranged on frames at such distances that they will pass through the cuts sawed in the backs of the sheets. The cords are kept taut by screws in the frames, and each sheet is sewed around these cords, but so that the whole pile of books sewed around the cords may be worked along, to allow of little ends of cord being left on each side, when the string of books, as it might be called, is cut apart. These ends are made firm with glue in the cover or casing, when that is put on, and glue entirely over the back also holds the cords in their places. After the sewing the edges have to be trimmed in a cutter, of which there are several styles, then the back is rounded by a machine, the volume being held in a sort of vise, which will yet allow the signatures to be slightly moved, when a roller moving in a circle is passed forward and back over the back of the volume. The old style of doing this work was by pounding the edges with a mallet, but the machine has entirely superseded this class of work.

The dexterity with which experienced hands can put together book covers cannot fail to be surprising to one witnessing the operation for the first time. A particular kind of thin muslin, made for the purpose, and furnished in as many different shades as there are styles of dress prints in a season, is the staple article for all "cloth" bindings. It is cut enough larger than the two sides and back of a book to allow room to fold the edges well over, but the pasteboard it is intended to cover is cut out, generally by a machine, of the desired shape and size. A workman will lay out a dozen of these muslin pieces for covers, brush them thoroughly with glue, place the pasteboard for the sides in position, put in a piece of thick paper or cardboard to stiffen the back, deftly fold over all the edges, and pass the whole pile through a press, almost before an observer comprehends what he is doing.

When the edges of a book are to be gilded this part of the work is done after the trimming, a great number of books being held tightly in a press, when the edges, which are trimmed so evenly and held so closely that they present a smooth surface, are brushed over with a thin sizing, made principally of isinglass glue, and the gold leaf is laid on and burnished with a hot iron. The stamping, or lettering on the covers in gold, is done very much after the same principle, the gold leaf being pressed in by a heated stamp. The embossing, by which the various designs of cloth covers are made, either plain or with ink impressed in the design, is done in a powerful press, especially built for this purpose, from metal patterns cut in a great variety of styles. After this the book is ready for the finisher, who puts on its case or cover, making the inside of the cover to match the fly leaf at the front and back, putting in a beaded or corded trimming around the back at top and bottom if desired, and remedying any imperfections which may have been allowed to pass in other portions of the work.

We have thus followed the book through, from the time the copy is put in the printer's hands until the volumes are ready to go to the shelves of the bookseller, but our notice would be incomplete without reference to the work done by what is called the "process" system of engraving. There are several patented methods of doing this work, and it is a distinct branch of business which has grown up entirely within the past fifteen years. By these processes a photograph is made of what is to be reproduced, from either a woodcut, a steel or copper engraving, a lithograph, a pen and ink drawing, or a page of printed matter. In this manner the publishers are now reproducing by photo-electrotypes the plates of Young's "Bible Concordance," a very elaborate work, in which, interspersed through the English text, are numerous quotations from the Greek, Hebrew, and Arabic, making a book which would prove a very difficult work for the most skillful compositor or the most accomplished proof-reader. In this way, however, the pages are simply put before a camera, when a negative is taken by which an exact impression is made through a thin film of wax, when all the other parts are eaten away by acids, leaving the clear representation of the picture or print photographed in relief with an accuracy which can only be secured by such process. From this wax mould electrotypes are made in the same way as from a type form.

A great proportion of the books first issued by the American Book Exchange were such as have long been the common property of mankind, irrespective of any author's copyright property, such as the works of Macaulay, Gibbon, Milton, Goldsmith, the ancient classics, etc., besides others, which, in the absence of any copyright treaties with other countries, all American publishers are at liberty to reprint. On several of their works, however, they pay a copyright to authors, and, from the great number of copies sold of every work they take up, a small percentage on each not only makes the author's remuneration considerable, but affords him the further gratification, of infinitely greater worth to most authors, of knowing that his efforts are appreciated by the reading public. Beyond this, however, the publishers have a special editorial corps of their own, including the names of authors who have for years enjoyed a high literary reputation, and their expenses in this department alone now amount to about $20,000 a year.

No mere statement, however, covering the details of this extended industry can give a correct comprehension of the value of the work to the general public which is thus being accomplished. A library of the best description is, by this system of publishing, made to cost so little that there are but few mechanics and laboring men in the country who cannot, if they will, become the possessors of the works of some of the greatest authors who ever lived. As a factor in the education of the rising generation its influence will be widely felt, for, of the 5,000 standard books a day now being sold at these low prices, it is safe to say that only a very small proportion would be taken at the prices which such works have heretofore cost. They now go to the masses, to people who buy because they want to read them, and not to use them to fill up so many square feet of wall space in a library, and the rapidity with which the demand is increasing affords the best possible evidence that the American Book Exchange is meeting an acknowledged want of the reading community.

The details of the business in every department are under the personal management of Mr. John B. Alden, Manager, in the Tribune Building, where the offices and a large retail store are situated.

Distribution of the Prizes of the Society of Encouragement in France.

The Society for the Encouragement of National Industry in France is one of the most admirable benefactors of that country, for, working in silence and without show, it encourages competition in industry and art by prizes and rewards. This society includes among its members eminent scientists, skillful manufacturers, and a number of men in all branches of knowledge, who act as judges in the distribution of prizes. The present president is M. Dumas. The prizes distributed this year are the following:

1. The great medal for fine arts (*Grande médaille des Beaux Arts*), the disposal of which lies with the Committee of Building and Art.

2. The great prize founded by the Marquis of Argenteuil, which is bestowed every six years.

3. The prize "Elphège Baude," for the perfection of the materials for civil engineering.

4. Several different prizes for competition by the society.

The great medal was given to Mr. Charles Garnier, the architect of the new Opera House in Paris. Mr. Rossigneux, member of the Committee of Building and Art, read, in the name of the committee, a report in which he gave a short description of this beautiful building, one of the grandest of Europe, and paid a fitting tribute to the merits of its author.

The grand prize of the Marquis of Argenteuil was received by Mr. Alphonse Poitevin for his remarkable improvements in photography. This gentleman had already received the highest awards of France, Russia, and Austria, during the International Exhibition of 1878.

Mr. Hersent, who has at present the supervision of the harbor repairs at Toulon, one of the most skillful engineers of France, was the recipient of the golden medal of the prize "Elphège Baude," on account of his important inventions for submarine structures.

Among the other prizes may be mentioned that given to Mr. Alexis de Bisschop for the invention of his small gas motor. The following problem was solved in the construction of this motor: The invention of a motor with rotation shaft, which furnishes to the workman who has to work in his own room a power of from 43 to 145 foot pounds per second. The construction of the motor must be such as to permit the regulation of the power according to the requirements, and without much difficulty. Mr. Bisschop's invention answers all these conditions perfectly. The model of his machine presented before the society gives 36 foot pounds, and uses only two cents' worth of gas per hour (Paris price). The cost of the machine is $100. These machines are constructed by Messrs. Mignon and Rouart, in Paris, who manufacture also a larger size, costing $180, and giving a power of 180 foot pounds per second, while the cost of the gas used amounts to five cents per hour.

A prize of $400 was offered for the invention of a means by which the shock and the vibrations produced in buildings by steam hammers, etc., could be nullified. Mr. Anthoni, who solved the problem, by introducing India-rubber plates between the foundations of the machine and the floor, received $100 of this prize.

A prize of $200 was offered for the utilization of the residues of manufactories. Camille Vincent, civil engineer, and Professor of Chemistry in the Central School, received this prize, for the creation of new industries, namely, the manufacture of methyl-chlorure, trimethylamine, and some interesting applications of refrigeration, the extraction of perfumes, etc. The importance of these inventions is well known to our manufacturers of aniline colors, and Mr. Massignon, a perfume manufacturer of France, has testified that by the employment of methyl-chlorure, he is able to extract 2,200 pounds of flowers a day in his manufactory at Cannes; the compression pump used by him being able to produce 134 pounds of ice per hour.

Mr. Abel Martin, of Paris, received the memorial medal and a prize of $200, for an invention which renders tissues and wood incombustible without destroying their color.

A silver medal was awarded to Mr. Idrac, of Toulouse, for a process for the quick desiccation of wood.

Mr. Goetz received $100 for his labors in the direction of reclaiming plains with quick grass.

A prize of $300 was awarded to Mr. Petit for the invention of a process by which a photographic plate can be converted into a typographic plate. The ingenious process consists in using bichromated gelatine plates, by means of which photographic pictures in relief are obtained, copies of which can be immediately used for printing.

Besides this, 13 gold medals, 9 platina medals, 14 silver medals, and 12 bronze medals, have been awarded for other useful inventions.

ENGINEERING INVENTIONS.

An improved pumping engine has been patented by Mr. Charles B. Wells, of Ronkonkoma, N. Y. The object of this improvement is to adapt such engines for pumping water, and specially for fire engines for use in situations where a steam fire engine would be too expensive. The invention consists in the combination with the cylinders of the engine, which are formed with water jackets, of a pump having its induction pipe connected with the jacketed space of the cylinders, so that while the pump is in operation the water passing around the cylinders will keep the cylinders and pistons cool and prevent the engines from becoming inoperative by unequal expansion.

An improved locomotive lift pipe has been patented by Mr. Thomas Plain, of Elmira, N. Y. The object of this invention is to insure better combustion in a locomotive and to prevent the accumulation of cinders in the locomotive smoke box.

An improvement in turbine water wheels has been patented by Messrs. Albert L. Moore and Norman S. Parker, of Portland, Oregon. This is an improvement upon the water wheel for which letters patent were granted to the same inventor January 17, 1871. The object of the improvement is to obtain both percussive and reactionary effect by the water upon the wheel, and to construct a gate so that it may be easily operated.

An improvement in fire engine boilers has been patented by Mr. Truckson S. La France, of Elmira, N. Y. The objects of this invention are to protect the crown sheet of the boiler from the dangers of low water, to raise steam quickly, and to prevent mud deposits in the boiler tubes.

Mr. Samuel Emery, of South Toledo, Ohio, has patented an improvement in that class of brakes in which the shoe engages with a wheel which is smaller than and independent of the wheels on which the car runs. It is particularly applicable to street railway cars.

An improved triangular truss bridge has been patented by Mr. Cyrus W. Wheeler, of Brownville, Neb. The object of this invention is to proportion the several parts of triangular truss bridges in accordance with the maximum stress to which they are respectively liable, thereby avoiding needless expenditure of material.

An English Magistrate on Patents.

The recorder of Walsall (Eng.), Mr. J. S. Neal, in charging the grand jury, said the recent boiler explosion at Walsall was a most appalling lesson of the danger that surrounded all modern machinery connected with steam, and of the necessity of adopting all safeguards that invention could suggest. It was within his knowledge that a patent to prevent boiler explosions, and which had every prospect of rendering such an accident as the recent calamity all but impossible, was on the point of being taken out ten years ago, but was delayed and would probably be lost through the unjust action of the patent laws. There was no law which ingenuity could frame which would confer a greater benefit on trade and commerce, and also on humanity at large, than a reform in the patent laws by a reduction to the smallest and most nominal amount of the fees and costs in taking out new patents, and in the place of such reduction, the substitution of an *ad valorem* duty of say five per cent on every sale or transfer of every patent which by its success had become valuable. The comparative trifle for which patents can be protected in America was one great cause why she has gone ahead of us in scientific matters.

The Wheat Crop of France.

Russia, being the chief wheat exporting country of Europe, is usually considered the greatest wheat grower. Yet the wheat crop of France is much larger, her annual crop being 286,448,000 bushels, against Russia's 224,000,000. Thanks to her abundant manufactories, France finds a market at home for all her wheat; and we hope the time is not far distant when the same will be said of the United States.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they are sufficiently accurate to enable the observer to recognize the planets. M. M.

POSITIONS OF PLANETS FOR OCTOBER, 1880.

Mercury.

Mercury may be seen late in October after sunset. It should be looked for some nine or ten degrees south of the sunset point.

On October 31 Mercury and the bright star Antares set nearly at the same time. Mercury can also be found by its position between Venus and the horizon.

Venus.

Venus may be seen after sunset all through the month, setting at 6h. 13m. P.M. on the 31st.

On October 20 Mercury and Venus will have very nearly the same declination, but Venus will be more than 6° east of Mercury.

Venus will be in conjunction with the crescent moon on the evening of October 5.

Mars.

Mars rises and sets so nearly with the sun that it is not likely to be seen in October.

Jupiter.

Jupiter comes into its best position in October. It is in opposition to the sun on the 7th.

The most interesting evenings in October will be the 9th, 16th, and 23d.

On the 9th (if the observer take the hours between 8 and 10 P.M.) the smallest satellite will be seen to come out from eclipse, and the next in line will pass off from the face of the planet. The planet will be seen early in the evening with two satellites only.

On the 16th Jupiter may be seen with two satellites, and as the largest satellite reappears from eclipse nearly at the same time that the first enters upon the planet's face, two moons must be seen near Jupiter.

On October 23 the largest and the smallest satellites disappear behind Jupiter within little more than an hour's time, while the first satellite approaches transit.

A telescope of three or four inches aperture will show markings and spots on the face of Jupiter, and the planet should be carefully watched by amateurs all through October, usually the best month in the clearness of the skies.

Saturn.

Saturn follows Jupiter, rising 33m. after Jupiter on October 1, and 37m. after Jupiter on October 31.

Saturn also comes into opposition in this month on the 18th. As the two planets are so near together in the skies, it will be easy to turn the glass from one to the other, and to notice the difference of light and color, the position of the ring of Saturn relatively to the planet, and the grouping of the satellites of Jupiter. And although a small telescope will show Titan only, among the numerous satellites of Saturn, it can be watched all around its revolution, and the slowness of its motion compared with the rapid motion of the satellites near to Jupiter.

A good glass of four inches aperture may show also Rhea, the satellite of Saturn next in size to Titan.

Saturn is in conjunction with the full moon on the morning of October 18.

Uranus.

Uranus must be looked for in the morning. It rises at 3h. 40m. A.M. on October 1. On October 31 it rises at 1h. 50m. A.M.

On October 31 Uranus is 2½° west of Delta Leonis, but nearly 14° south of the star in declination. It will be difficult to find it in the early morning hour without a well mounted telescope.

Neptune.

Neptune is approaching opposition and passes the meridian on October 31 almost exactly at midnight, at an altitude in this latitude of more than 62°.

Gould's Comet.

Professor Klinkerfues, of Gottingen, has published a letter on Gould's comet, discovered last February at Cordoba. His object is to point out that the probable identity of this comet with those seen in 1843 and 1868 need not be rejected because it does not appear to have been seen, although so conspicuous an object between those years. So nearly does it approach the sun (within, indeed, about 100,000 miles of its surface) that the resistance to its motion when at perihelion is likely to be sufficient to produce a very considerable diminution in its periodic time, the case being, in fact, one of resistance from the sun's atmosphere itself, and not merely, as has been conjectured in the case of Encke's comet, from the ethereal medium existing in space. Hence there is nothing extravagant in the supposition that the resistance of the part of the corona within which the comet passes may be quite sufficient to diminish its period of revolution from 175 years to 37 years. Carrying this view still further back, Professor Klinkerfues contends that it is probable that the same comet may be identical with one seen and described by Aristotle in the year B.C. 371, when that philosopher was only thirteen years old and still living in his birthplace, Stagira. He considered it likely that while the period of revolution from B.C. 371 to A.D. 1668 was 2,039 years, it was diminished by the resistance of the sun's atmosphere, first to 175 and then to 37 years; and, further, that it has at the late passages through perihelion been again decreased to 17 years, so that it may be expected that the comet will return in the autumn of 1897.

HINTS TO THE YOUNG STEAM FITTER.

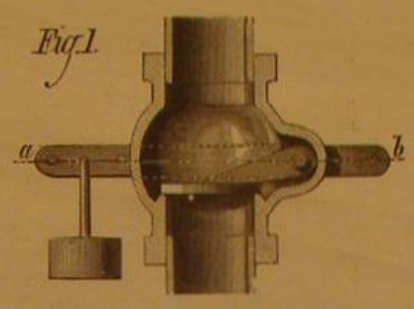
BY WM. J. BALDWIN.

EXHAUST STEAM AND ITS VALUE.

Among the many who own steam engines and the engineers who run them there are few who have a just appreciation of the *thermal* value of the clouds of exhaust steam continually blown to the winds from the apparently numberless exhaust pipes, which can be seen from the top of a high building in any of our large cities.

When I say that three-quarters of the *practical* thermal value of every pound of coal burned in the boiler furnace is lost past recovery to the consumer, I am putting it at less than the actual loss; and could this heat be converted into available motion, suitable for power purposes, it would be a boon indeed, and money in the pockets of the one who could do it. Perhaps there is a chance for the electrician to convert it into energy; but as yet engineers can use it for heating purposes only, where its full value can be shown in the heating of water, air, or any tangible substance.

Fig. 1.



The first purpose the exhaust steam is generally used for is to warm the feed water, the object being to raise its temperature as high at possible before it enters the boiler, thereby to save fuel.

The first question which nearly always suggests itself to the engineer is, How hot can feed water be made? The second which he sometimes considers, but seldom arrives at a satisfactory conclusion about, is, What percentage of the coal heap does the heating of the feed water represent? and the third, which rarely comes under his notice, is, How much of the exhaust steam from an engine can be used in heating all the feed water necessary to supply the loss caused in the boiler by supplying steam to the same engine? and how much of it is left for use elsewhere, partly or wholly, to heat the *factory* in winter or for drying purposes?

The answer to the first question is: Water under the pressure of the atmosphere cannot be heated above 212° Fah., and when the feed water passes the check valve at a temperature of 200° it should be considered good, although it is possible to do better.

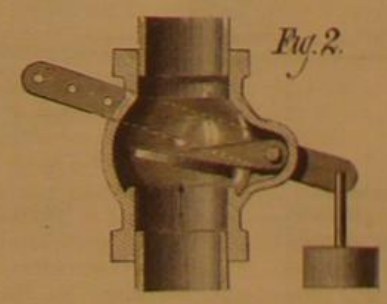
Where water is *forced through* a heater the temperature can be raised higher than when drawn by a pump *from* the heater, as the lessening of the pressure also lessens the capacity of the water for *sensible* heat.

Some makers of feed water heaters claim they can heat the water above 212, because it is under pressure; but it is evidently a mistake to attempt it, as both the water to be heated and the steam necessary to heat it should have a pressure above atmosphere, and any attempt to keep a back pressure in the exhaust pipe for the *simple purpose only* of warming the feed water above 212° is attended with a loss instead of a gain.

The attempt to heat the feed water 5° above 212° by a back pressure of 2 pounds, the mean pressure in the cylinder being 50 pounds, is attended with a loss in energy more than five times greater than the gain to the feed water.

The answer to the second question is: That when the feed water is raised from *mean temperature* (39°) to 212°, by the use of the exhaust steam at atmospheric pressure, it is equivalent to very nearly two-thirteenths of the weight of the fuel necessary to convert water at *mean temperature* to steam at *any pressure*, and 15·18 per cent of the coal heap is the greatest possible saving that can be made for this difference of temperature.

Fig. 2.



To find the saving for other differences of temperature in the feed water, divide the difference between the temperature of the cold water as it enters the heater and that at which it enters the boiler into 1,146, less the difference between the cold water and 32, and the product is the fraction of the coal heap.

The answer to the third question is: That two-elevenths of the exhaust steam is the greatest quantity that can be utilized in the warming of the feed water, and making a generous allowance for loss by radiation, etc., there will still be three-fourths of all the exhaust steam for other purposes.

The next general purpose for which the exhaust steam from an engine can be used is in the warming of the air of a building, to which purpose it is often applied, though not as much as it should be, as there appears to be an idea among many users of steam that it is just as well to take live steam from the boiler as to cause one or two pounds back pressure on the engine for the purpose of getting a circulation and driving the air from all parts of the coils.

The loss in power to an engine from back pressure is very nearly directly as the difference between back pressure and mean pressure. Thus, in an engine of 50 pounds mean pressure, with a back pressure of 2 pounds, there is a loss of 4 per cent, and as the available energy of an engine cannot represent one-quarter of the *practical thermal* value of the coal, the loss caused by 2 pounds back pressure cannot represent more than 1 per cent of the coal, and as it is an incontrovertible fact that the exhaust steam contains more than three-fourths or 75 per cent of the *practical* thermal value of the coal, the balance is largely in favor of using the exhaust steam. The steam fitter when preparing to use the exhaust, usually places a *back pressure valve* in the exhaust pipe of such construction that it can be loaded to suit, so as to reduce the back pressure to a minimum when in use, and to hold it open when not required.

Fig. 3.

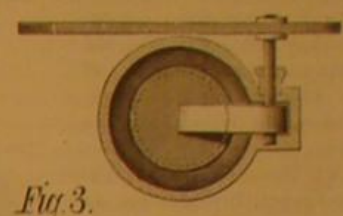
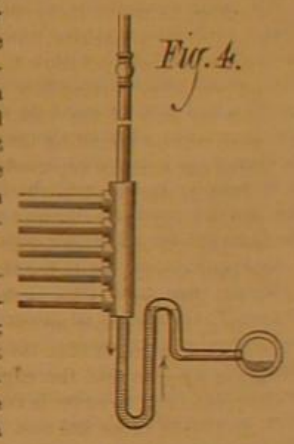


Fig. 1 shows a section of a back pressure valve with the weight hanging on the positive end of the lever, showing the position of the valve when the steam is turned into the coils. Fig. 2 shows the weight on the negative end of the lever, the position usually used in summer. Fig. 3 shows cross section on line *a b*, Fig. 1, to show stuffing box and spindle.

Exhaust and live steam should never be used in the same coil at the same time. It is often attempted, but is very difficult to regulate, and the better way is to make the exhaust coils no larger than there is steam enough to fill them, and should this not prove sufficient for the space to be heated, add live steam coils with entirely independent connections.

Fig. 4.



Sometimes coils are furnished with two sets of connections, live and exhaust; but this requires constant attention to prevent workmen, etc., from crossing the steams, thereby causing a waste.

Another objection to having live and exhaust steam connections on the same coil is the style of trapping used for one is not fit for the other.

A very good way to *trap* and provide for the condensed water from an exhaust steam coil is to have an inverted water siphon to the sewer or tank, as shown in Fig. 4, with a vapor pipe to the roof to remove an excess of pressure and the air. This pipe should have a check valve on it to prevent the return of the air between the strokes of the engine, and the water trap should be as deep as possible.

MECHANICAL INVENTIONS.

Mr. John P. McKinley, of Black Hawk, Miss., has patented an improved sawmill head-block, by means of which the knees of the head-block can be adjusted by the driving power of the mill, and it is so constructed as to enable the sawyer to set the head-blocks very quickly and accurately.

An improved machine for filing gin saws has been patented by Mr. Alexander F. McAllister, of Marshall, Texas. This machine employs rotary files, and is supported and guided by arms which engage the periphery of the saw.

Mr. Marcus M. Rhodes, of Taunton, Mass., has patented an improved apparatus for gauging and assorting disks of varying thickness, for coins, buttons, and other purposes. The invention consists of an improved mechanism for feeding disks or planchets to gauging calipers of a sliding spring caliper bar, the range of whose every movement is determined by the thickness of the disk being gauged, and a group of receiving tubes reciprocated beneath the calipers by novel mechanism.

An improved machine for making rubber belting has been patented by Mr. Jacob D. Joslin, of Trenton, N. J. This machine is intended for receiving the stock and folding and preparing the belt for vulcanization.

An improved wrench or pipe-tongs that may be adjusted without screws has been patented by Mr. Theodore P. Franke, of Buffalo, N. Y. The invention consists of a hollow internally-socketed handle, containing in its upper section a movable serrated lower jaw resting upon a spiral spring, and adjustable by means of a rod that passes up through the handle.

A RECENTLY patented compound for flavoring cigars consists of rum, alcohol, oil of apple, tonka bean, valerian root, and laudanum. Such are the vile doses that go into the smoker's mouth.

MISCELLANEOUS INVENTIONS.

Messrs. James B. Campbell and Josiah Lindsay, of Mount Sterling, Ky., have patented a cheap and durable washboard, designed to force the water through the clothes by a more substantial resistance to the hand than is afforded by other washboards. The invention consists of metal rods running laterally across the face of the board, parallel to each other and at equal distances apart, and partly bedded in the board, grooves being made in the spaces between the rods, thus substituting the rods and the grooves between them for the corrugated metal sheet which commonly covers the face of a washboard.

An improved vehicle wheel has been patented by Mr. Charles W. Ball, of Macon, Ill. The object of this invention is to construct a light, durable, and easily adjusted vehicle wheel, cast from steel or other metal, with hub, spokes, and felly all in one piece.

Mr. Paul Gondolo, of Paris, France, has patented an improved process of manufacturing tannin extracts, which consists in the following consecutive steps: First, macerating the crude material containing the tannin in slightly acidulated water; secondly, neutralizing the free acid by an alkali or its equivalent, as described; thirdly, clarifying the solution by the introduction of blood, and then raising the temperature to the coagulating point of the blood, and finally separating from the tannin liquor the coagulated blood, with the salts and coloring matter, by filtration.

An improvement in oil stills, patented by Mr. Gerard Crane, of Salamanca, N. Y., consists in a novel arrangement of a small still within a larger or main still, and another small still outside of the main still, and a novel combination and arrangement of devices employed in connection therewith, whereby the process of distilling the oil is facilitated and hastened by enabling the oil to give off the more volatile products of distillation at the same time that the heavier products are being given off, and by means of the same fire for all of the stills.

An improvement in that class of devices known to the public as "bale-band tighteners," has been patented by Mr. Charles T. Christmas, of Riverton, Miss. It consists of two end curved and cross-pivoted bars, having on corresponding sides of the ends a swiveled slotted block and cam lever.

Mr. Gilman P. Richardson, of Bath, Me., has patented an improved means for fastening together the ends of the metal bands which serve to bind together the staves of large tanks, barrels, hogsheads, or tubs. It is made in the form of two strong tubes cast together, with their axes arranged obliquely to each other. Through the tubular openings in the tie the rounded ends of the band are to be projected, and then secured upon the opposite sides of the tie by screw nuts.

Mr. Montraville W. Atwood, of Clayton, N. Y., has patented a center-board that may be applied to any boat, but is specially adapted to a row-boat, without interfering with the oarsmen, and be contained within a box that is water-tight, excepting at its bottom or keel opening, which box may be arranged beneath thwart of the boat. It consists of a center-board constructed of two or more pieces or leaves, so that they may be folded and opened and elevated and depressed at pleasure by means of a bolt and lever, the center-board being contained in a low water-tight box above the bottom of the boat.

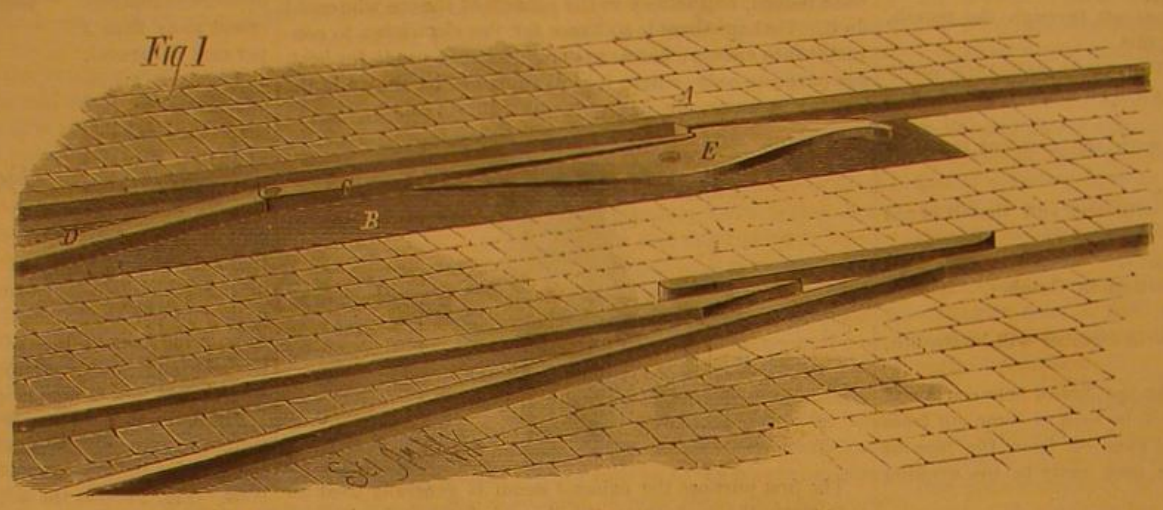
An improved spring hinge has been patented by Mr. George Keene, of Chicago, Ill. The improvement consists in placing the pintles of the gate or door forward of its rear edge, which is provided with a downward projection, and in applying a spiral spring to the lower pintle, so that its free ends project backward on each side of the projection on the gate or door, but do not bear against it except when the gate or door swings, being at other times in contact with studs which are fixed in the pintle bracket.

IMPROVEMENT IN RAILWAY SWITCHES AND CROSSINGS.

We give herewith three engravings representing some recent improvements in railroads patented by Mr. John B. Carey, and now being introduced by the Carey Switch Company, of Boston, Mass. Fig. 1 shows a switch especially intended for street railways, and designed to afford a means of operating the switches of street railways without the necessity of leaving the car to operate it.

The main track rail, A, and the other portions of the switch are supported by a base plate, B. The swinging

Fig. 1



STREET RAILWAY SWITCH.

tongue, C, is pivoted at the end of the branch track, D, in the usual way, and is capable of being acted on by the lever, E, which is pivoted to the base plate, B, near the free end of the tongue, C, and has a curved end which projects beyond the end of the tongue, so that it may be engaged by the flange of a car wheel when it is desirable to switch the car from the main to the branch track. The tongue, C, is recessed on its under side, and contains a spring which is attached to its pivot and tends to keep the free end of the tongue away from the main track. As a car approaches a siding or turnout on to which it is to be switched, and as the front wheels of the car arrive opposite the curved end of the lever, E, the car is pulled by the draught animals toward the side of the track opposite the lever; the result is that the end of the lever is forced inward toward the center of the track, thereby crowding the opposite end and the free end of the switch tongue in the opposite direction, thus isolating the main track and opening the branch, the tail of the lever, E, being of less height than the portion of the switch against which it abuts, in order that it may present no obstruction to the flanges of the wheels as they pass along the tongue. When the lever and tongue are in their normal position—that is, when the main track is open—their meeting faces are parallel, and the pivot of the lever forms a stop to the inward movement of the tongue and determines the extent to which it is moved by its spring. When the car returns from the turnout to the main track the "dummy," so called, upon the side of the track opposite the tongue and lever diverts the car toward and upon the main track, the wheels of the car upon the switch side crowding the tongue, C, outward against the main rail and permitting of the passage of the flanges of the wheels between the tongue and the lever. The length of the free end or nose of the lever is equal to or somewhat greater than the distance between the axles of the cars, in order that the front wheels of the car, in running from the main track to the turnout, shall not pass by the pivot of the lever until the rear car wheel has entered between the lever and the rail. This switch has been six months in operation at Chestnut and Thirty-third streets, Philadelphia, and is said to work perfectly. Fig. 2 shows, in perspective, a switch adapted to steam railroads, and which, it is claimed, will prevent the derailment of a car whatever the arrangement of the switch or the direction of the train. In this switch a triple rail sliding frog, A, is employed; the main track rail, B, having in it an opening for receiving the frog and in which the frog slides transversely. The main rail, C, is continuous throughout, and is provided with a guard rail, D, supported by a plate resting on the ties. This guard rail terminates at one end at a point opposite the center of the frog, A. The space between the guard rail, D, and the rail, C, is tapering, being the largest at a point opposite the middle of the frog, A. This space is large enough to allow the wheels on one side of a car or locomotive to pass obliquely on the plate from one side to the other of the point of the branch rail, F.

The movable frog is operated by means of a lever in the usual way, and may be held in either of its positions by a pin passing through the switch operating lever and its curved guides. The legitimate operation of this switch is as follows, taking for the first example the position of parts shown in Fig. 2, that is, with both rails of the main line intact, the frog being at its extreme outward position: In this position it is hardly necessary to explain that both rails of the main line are intact; but when a car, for instance, upon the turnout, is approaching the switch in this position, that is, with the switch misplaced for the turnout, the front and hind wheels of the car in succession, upon the side next the frog, on leaving the turnout rail, E, traverse the central tongue or reserve rail, A, until the end of the rail, B, is reached, when they will enter the groove or channel, *d*, ascend its inclined bottom, and ride upon the top of the block or plate, and travel along the latter, the flanges of the wheels upon the opposite side of the car in the meantime engaging with and being guided by the guard rail, D, compelling the car to travel obliquely in relation to the main track until the point of convergence of the guard, D, and rail, C, is reached, when the guard rail leads the tread of the wheels upon its own side to and upon the adjacent part of the rail, and those upon the opposite side of the car from the block, to and upon the rail, B, switching the car in safety from the turnout to the main track should the switchman neglect to shift his switch.

Fig. 2.

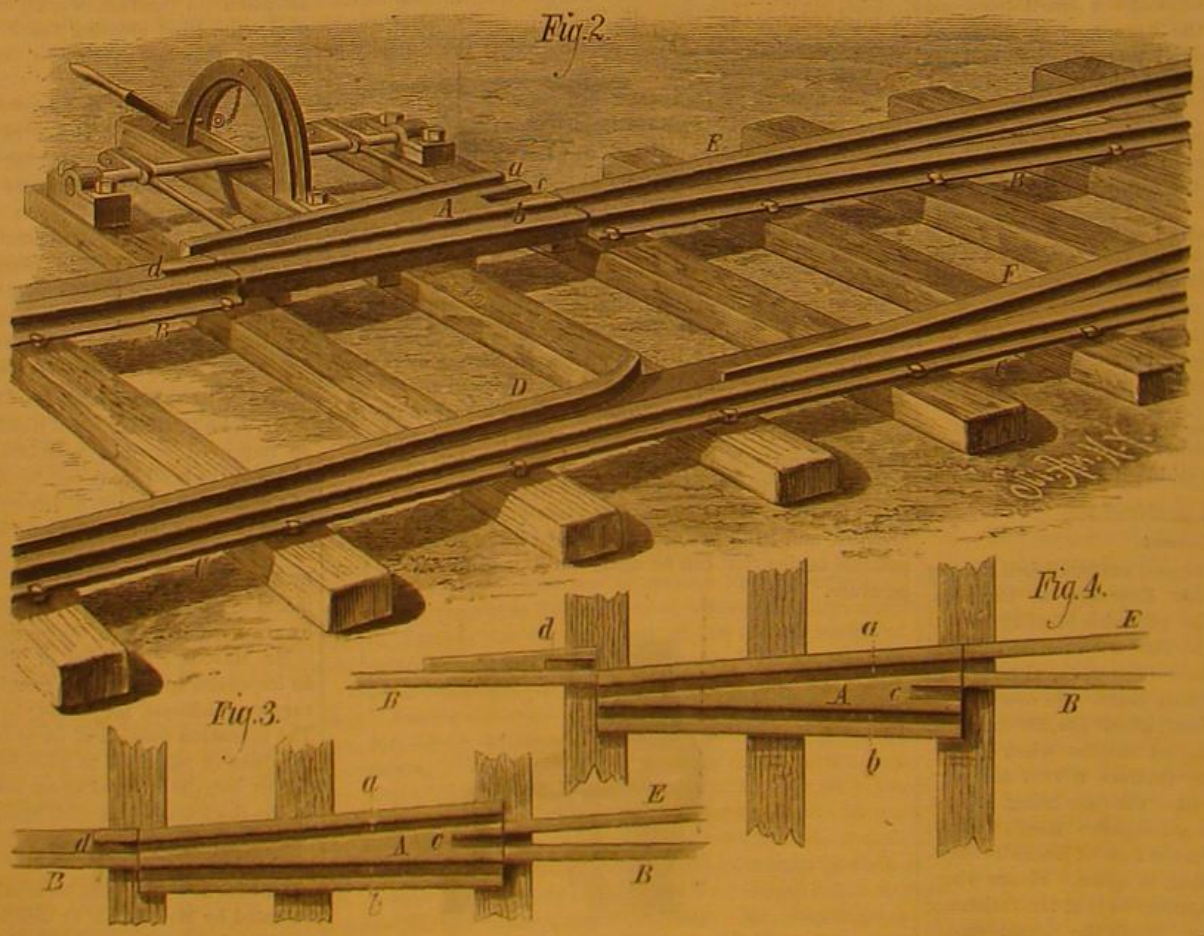


Fig. 3.

Fig. 4.

STEAM RAILWAY SWITCH.

When the movement of the hand lever is reversed, and it is lowered in the opposite direction, as shown in Fig. 4, the switch is set for the legitimate use of the turnout, and establishes direct connection between the turnout rail, E, and the end of the main rail, B. In this instance, if a car is approaching the switch from the right hand, the car is switched off legitimately from the main line to the turnout.

As the car travels in the opposite direction the result is the same practically, except that the order of the movements is reversed. While the wheels of the car nearest the frog travel from the turnout to the main track over the frog rail

A, under the control of the tongue, A, the opposite wheels, after leaving the rail, F, travel obliquely over the plate which supports the guard rail, D.

Should the main rail portion, *b*, of the frog become worn to such an extent as to require renewing, the tongue, A, becomes available. In this event the switch lever is to be turned into a perpendicular position, and the inner face or edge of the tongue establishes communication between the two ends of the main rail, B, as shown in Fig. 3, the rail, *b*, of the frog being out of use.

With this position of the frog the switch is misplaced for the turnout in both directions, and should a car upon the turnout accidentally approach the switch, its wheels upon the side next the frog will successively enter the groove, *c*, ascend its inclined bottom, and ride upon the top of the tongue, G, and will traverse the latter until they drop between the tongue and the outer rail or guard, *a*, and will, by the latter, conjointly with the tongue, be diverted into the groove, *d*, ascend the inclined bottom of the latter, and ride upon the top of the block, *e*, and traverse the latter, while at the same time the wheels upon the opposite side of the car, in succession, leave the point of the rail, F, traverse the base plate until they run against the guard, D, and will by the latter be diverted to the main rail, *c*, the opposite wheels, at the same time and by the same means, leaving the block, *e*, and taking to the main rail, B, thus safely leading the car from the turnout to the main track.

It will thus be seen that the continuity of one rail of the main line is never ruptured or interfered with.

Figs. 5, 6, and 7 represent an improved railway crossing by the same inventor. The novelty lies in the peculiar construction of the cruciform chairs which support the tracks at their intersection and receive the bed timbers. The crossing shown in the engraving consists of two single lines crossing each other at right angles, but the device is applicable to two or more tracks crossing each other obliquely, and is capable of being applied to either horse or steam railways.

The chair, A, which supports the tracks at the point of intersection, is shown in detail in Fig. 6. It consists of a flat plate in the form of a Maltese cross, having ribs, B, for confining the ends of the several tracks, and provided with a ledge for separating the ends of the rails of one track, forming a flangeway for the car wheels. The cross-shaped casting has pendent ears, *c*, for embracing the timbers, as shown in the engraving.

This device renders what is usually the most unreliable part of the road as strong, durable, and reliable as other portions.

Further information in regard to these inventions may be obtained by addressing the Carey Switch Company, 25 State street, Boston, Mass.

Fig. 5

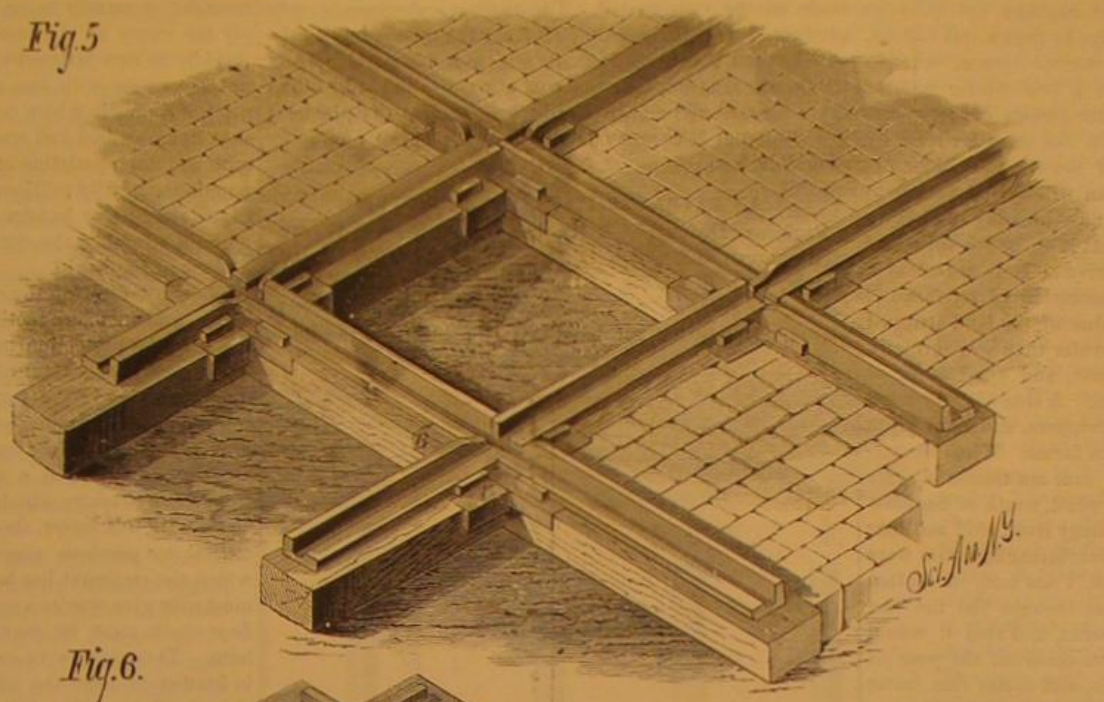


Fig. 6.

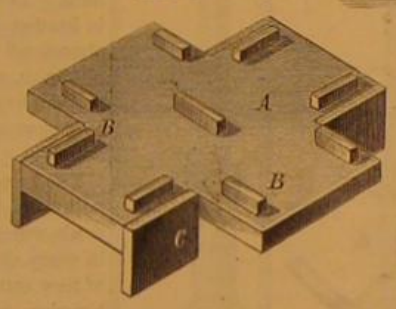
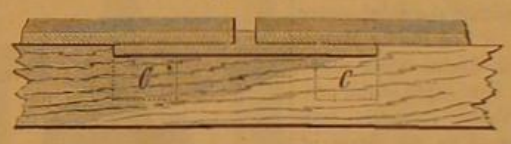


Fig. 7



RAILWAY CROSSING.

THE GRANNY WHALE.

BY A. W. ROBERTS.

"The granny whale," "long-tailed unicorn fish," "file fish," "old wife," "trigger fish," and "fool fish," are the common and local names given to a variety of fish ranging from Cape Cod to Florida, and known to naturalists all the world over as the *Alutera cuspicauda*, but from its supposed resemblance in outline to a whale, and its generally very aged and infirm look, suggests the possibility of its being the great-great-grandparent of all fish. An adult specimen, when taken from the water, conveys the idea of its being but a mere framework of bones, enveloped in a loose-fitting, baggy, moth and tan blotched skin. Its grinning, gumless teeth, and the feeble resistance it offers when handled, suggested to the fishers of Long Island the name of "old wife," the mother of all fish. It obtains the names of unicorn fish and trigger fish from the fact of its having a prominent movable spine situated on the forward part of the dorsal ridge, which is suggestive of a unicorn's horn or a trigger handle. The name file fish was given to this fish on account of its skin being covered with minute but very keen asperities, suggestive of a fine file, emery paper, or shagreen. From the fact that it is exceedingly awkward in the water, often standing on its head with its unwieldy tail pointing directly upward, and at other times assuming an upside-down position, and the ludicrous attempts it makes at rapid swimming, together with the meaningless expression of its bulging eyes, and its generally eccentric appearance, have caused it to be dubbed the fool-fish, for it is truly a burlesque on all fishes.

There are now on exhibition at the Aquarium several unusually fine living specimens of this fish, measuring from fifteen to twenty inches in length, which were captured by W. I. De Nyse, of Gravesend Bay, L. I.

The young of the alutera is described by De Kay as a separate variety under the common name of the long-tailed unicorn fish, and the adult he names the orange file fish. In local color and markings the young of the alutera are very different from adults, they having longitudinal markings of a rich purplish-black and brown, extending from the nose to the tail, while the adults are of a general dingy orange color with markings of light brown in blotches.

In a tank at the Aquarium I placed some fifteen specimens of young alutera that were taken at the swimming baths at the foot of 85th street, East River, they having been attracted there by the immense quantity of tubularia growing on the timbers of the bath. I fed these young aluteras on clams at first, some of which remaining in the tank uneaten, I threw into the tank a couple of handfuls of Buccinum snails to clean up the uneaten food. Much to my surprise the young file fish set upon the snails, rapidly biting off their probocis. This fact led me to establish a tank with deep sand bottom, in which was thickly planted numerous small soft clams. When these had become thoroughly established I moved all the young file fish into the clam tank, the result being that in less than an hour's time not a single clam was left with a perfect siphon. Tubularians and other zoophytes are the favorite food of the file fish, they being furnished with teeth closely resembling the rodent quadrupeds', there being a provision for adding fresh substance to the tooth as fast as it is worn away.

It was astonishing how rapidly the largest masses of tubularia were mowed down close to the base by the sharp teeth of the file fish. These fish have the power of rapidly changing colors to a remarkable extent, so that when placed in a dark tank they become almost entirely black, and in a tank thoroughly illuminated with sunlight they assume a light yellowish color.

THE GRANNY WHALE.—(*Alutera cuspicauda.*)

Shower of Water Beetles.

The people of Owensville, Mount Sterling, Sharpsburg, and intermediate places in Kentucky, were recently astounded by a veritable shower of large brown, oval-shaped beetles, measuring about one and a half inches in length by half or three-quarters of an inch in breadth. They proved to be the well known water beetle (*Dysticus roeselius*). Whether they were migrating or had been swept into the air by a whirlwind, does not appear.

Fasting Horses.

To determine the capacity of horses to undergo the privations incident to a state of siege, a series of experiments were made with these animals in Paris, some years ago. The experiments proved (1) that a horse can hold out for twenty-five days without any solid nourishment, provided it is supplied with sufficient and good drinking water. (2) A horse can barely hold out for five days without water. (3) If a horse is well fed for ten days, but insufficiently provided with water throughout the same period, it will not outlive the eleventh day. One horse, from which water had been entirely withheld for three days, drank on the fourth day sixty liters of water within three minutes. A horse which received no solid nourishment for twelve days was nevertheless in a condition, on the twelfth day of its fast, to draw a load of 279 kilos.

Two Patriarchal Apple Trees.

In Skowhegan, Me., are two russet apple trees; the oldest was planted in 1762. The tree is seven feet from the ground to the branches, five in number, all of which are very large and average 35 feet in length, covering a space of ground 63 feet in diameter. In these branches a playhouse for children has been built for half a century or more. Anywhere from the ground to the branches it measures 13½ feet. The tree is more than 4½ feet in diameter, and it has been a good bearer—from twenty-five to thirty-five bushels of apples having been picked from it each year. But the frost and rain have made a seam in the branches, and recently one of them has broken, but the other four are green and bring forth their fruit in due season. The other tree, forty-eight years younger, is a sprout of the old tree. It stands thirty-two feet from the old tree, and bears the same kind of apples, is three feet in diameter, and perfect in every way. This farm was deeded to the grandfather of Coburn Ireland in 1760, has passed

from father to son until 1876, and then passed into the hands of Daniel H. Gould, the present owner.—*Boston Transcript.*

The Pine Tree Passing Away.

A correspondent of the *Cincinnati Gazette*, writing from Alpena, Mich., says:

Alpena is one of the many Michigan towns that are springing up along the lake shore at the mouths of rivers whose tributaries flow through the great pine forests of the State. Every river throughout the constantly receding timber belt of Michigan, now reaching from the Saginaw Valley to the Straits of Mackinaw, sufficiently large to float a raft of logs, becomes a highway between the lumber camps, wherein motley crews of men, gathered for a few winter months from all nations of the world, rob the forests of their precious pine. The time is near when the pine hoarded by nature for ages within the bosom of her forests will be exhausted; when the rough woodsman will have departed to other lands; when the saw mills, now bustling with life, will stand silent and deserted. What is to be the future of this region when that time shall arrive? Is it to remain a useless waste, awaiting the slow restoration of its forests? It is certain that the agricultural value of the land stripped of its pine is proving to be much greater than was formerly supposed. Clearings are being made, and good crops of wheat, oats, hay, and potatoes raised. A tide of emigration in this way is following the woodchoppers, and converting the mutilated forests into prosperous farms. When the terrible forest fires of Michigan swept over ten thousand acres of pine land along the Lake Huron coast, south of Saginaw Bay, and destroyed whole towns, many lives, and millions of dollars' worth of property, the lumbering interests were utterly destroyed. Not a single mill, I am told, in all that region has since been built. It was thought the fire had ruined the future of the burned district, and that it would be henceforth valueless. These fires occurred the year of the Chicago fire, just nine years ago, and to-day this burnt district is said to be the finest farming region of the State.

The destruction of the pineries of Michigan, Wisconsin, and Minnesota is a matter of importance. How long will the forests of these three States, that contain the chief stores of pine timber on this continent east of the Rocky Mountains, continue to supply the enormous drains being made upon them? One example will show how rapid is the process of destruction. The Saginaw Valley formerly contained the largest and finest pine forests in the State of Michigan. Mill after mill was built along the banks of the river, until their united capacity reached six hundred million feet of lumber per year. To supply these mills the pine in the Saginaw Valley has been already in great part exhausted, and mill owners are obliged to bring logs from other rivers, often as far as one hundred and fifty miles distant, to supplement the stock of the Saginaw River. The output on that river has reached its climax. No more new saw mills are built or old ones replaced. The business must gradually diminish in volume until the Saginaw Valley, now the greatest lumber district in the world, shall hear the buzz of the saw no more.

Talking to a gentleman of Alpena, who has witnessed the growth of the lumbering business of that place almost from its commencement, and whose business for years has kept him accurately posted as to the quantity and location of the pine in the Alpena district, he said that, dividing the number of millions of feet of pine timber tributary to the Alpena river by the annual capacity of the Alpena mills, it gave them fifteen years' supply. These figures agree very closely with those given me a few weeks ago by the president of the largest logging company on the Mississippi River, operating in the Wisconsin pineries, a region that had been worked much less extensively than the Michigan pineries. They would last, he said, thirty or forty years. The Minnesota pineries are not so large as either of the others, and will probably not survive them. In from twenty-five to forty years the last tree will be cut, and the entire country from Maine to the Rocky Mountains must learn to live with meager quantities of pine lumber brought at great expense from distant countries.

The pineries cannot be replaced. A full grown tree represents hundreds and hundreds of years of growth. I saw small pines, no larger around than a man's arm, bearing the scars made by the axes of the United States Engineers thirty-five years ago. What ages, then, must be required to produce a tree three or four feet in diameter? When these forests reach the condition of the pineries of Maine and New York, and become extinct, no new ones will take their places. The American of the near future must learn to hew and build without pine, and marvel at the thoughtless recklessness of his ancestors.

Rust-Proof Iron.

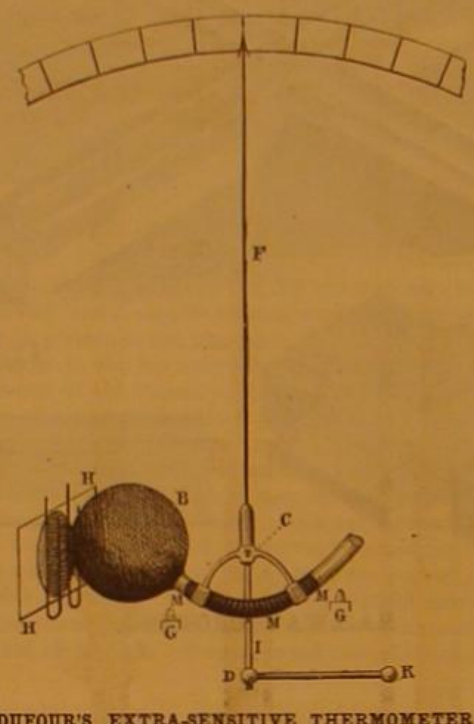
Mr. George Bower has invented, and his son has improved, a process for coating iron with an indestructible surface of magnetic oxide, which is said not to be open to the objections to the Barff process.

The process, which is not secret, consists in heating the articles to be coated in a closed chamber by means of carbonic oxide, heated air being made to enter the chamber for the double purpose of burning the gas and for combining with the iron. The excess of air, after burning the carbonic oxide gas, combines with the iron, forming first the magnetic oxide, and then the hydrated sesquioxide, or common iron rust. By shutting off the supply of air until only enough is admitted to burn the carbonic oxide, the rust is converted into the magnetic oxide. The process is repeated until the film is sufficiently thick for the purpose of protection. When complete the film has a beautiful French gray tint.

The London *Times* states that the application of this invention has been undertaken on a large scale, the chamber where the oxidization is now carried on being large enough to contain about a ton of miscellaneous articles. The value of the invention, and of the method of applying it, is no longer a matter of doubt, the severest tests having been made of the iron coated. The earliest experiments only produced a film that would peel from the metal; but by the new method a coating is made which is inseparable from the metal. Inasmuch as the cost of oxidization is less than that of a coat of paint, it has become evident that the next generation, at least, may be happy with cheap and indestructible iron.

AN EXTRA-SENSITIVE THERMOMETER.

Professor Dufour, of Paris, has devised a small thermometric apparatus, which is so sensitive that it will even denote, by a deflection of the index needle of nearly two inches, the entrance of a person in the room where it is placed. By putting the hand near the bulb the needle is



DUFOUR'S EXTRA-SENSITIVE THERMOMETER.

deflected the whole extent of the graduated arc. This apparatus, which we find described and illustrated in *La Nature*, consists of a bent tube, M, carrying at one end a bulb, B, which is coated externally with lampblack. The tube is filled from M to M with mercury, and is supported by arms pivoting at C on a steel knife blade. Just above the pivot is fixed an index needle which moves across a graduated arc. Beneath the pivot hangs a rod, I, to which is attached by friction a small weight, R, that serves to balance the needle so as to make it point to zero on the arc. When the temperature rises, be it ever so slightly, the heat, being absorbed by the lampblack, dilates the air in the bulb, B, and drives the mercury forward. The center of gravity of the apparatus being displaced, the needle will immediately turn toward the right. When, on the contrary, the temperature decreases the needle will point toward the left. To prevent the instrument tipping over on a sudden and considerable elevation of temperature, two small pins are placed beneath the tube at G G. The hooks seen near the bulb serve to hold substances whose diathermic powers it is desired to ascertain. The heat source is introduced into the aperture in the plate, H H.

Coret's Thermometer.

Coret solders end to end many concentric tubes of different metals, steel and zinc for example. By alternating the joints the differences of dilatation are added, so that the last tube, being connected with a toothed wheel or series of levers, gives a great motion to a needle, sufficient to indicate small fractions of a degree of temperature. The metals being good conductors, the indications are rapid when the metallic mass is placed in contact with any body of which the temperature is desired. The tubes can be concentrated in a space of less than two centimeters (0·79 inch). The thermometer is, therefore, very convenient for medical use. —*Bull. de la Soc. d'Encour.*

Where the Lumber Goes.

Were any illustration needed to exemplify the fact that the demand for lumber and timber product was on the increase, it were only necessary to see the immense quantities which are being shipped daily to the far West, and to examine the order books of our principal yard dealers. Shipments to Nebraska are nothing more than is found in the ordinary course of trade, but these as a rule are to established yards; but when it comes to shipments to points far from the line of roads, and where a large cartage expense is necessarily entailed, we begin to realize that the country is rapidly settling up, in advance of the building of railroads, which will each month make demand for greater quantities of lumber in the building of houses, barns, granaries, and fences.

Shipments have been made, during the past week, of fencing for points fifty miles north of the Union Pacific Railroad, three hundred miles west of Omaha. This and other shipments to the same State is to be used in building fences around cattle ranges, at points where, but a few years back, the wild Indian roamed at will in his hunt for the buffalo which abounded upon the broad prairie that is now brought, or rapidly being brought, into subjugation to supply the wants of a numerous population of civilized men. Rapidly as new railroad systems are being created, they do not keep pace with the restless activity and daring enterprise of a people which has spread in a single century from the circumscribed and sparsely settled coast of the Atlantic, with its total population of four millions, to an equally sparse population of fifty millions scattered over a continent capable of sustaining five hundred millions, without crowding and without attaining the density which characterizes the older nations of the world.

The grain crop of the season is unexampled in its abundance, and in many sections but scant provision has been made for its protection pending its sale. Since the harvest has disclosed the extent of the property to be taken care of, the poorer among the farmers having ascertained that they can pay for it, are now looking for the lumber requisite to protect the grain they have raised, and the cry, while imperative, comes from a newly-settled country, as well as from those portions which have been longer under improvement. In this latter, the crop of this year is but supplemental to previous successful ones, and the dug-out in which the emigrant has been content with a simple shelter, must now give way to a comfortable dwelling, while the outdoor stack must be more safely housed in granary or in barn. There is now no endeavor on the part of the dealer in lumber to urge the sale of his stock. It is wanted in almost all localities fully as rapidly as the dealers can obtain it, and in this market the demand is as heavy as the dealers desire to turn over their stocks, and, so far as assortments go, heavier than they can conveniently supply.

The condition of things described above is a full explanation of the immense demand for lumber from the railroads which are extending main lines and building branches in every direction, to accommodate and to extend the area of new settlement, and as well to take advantage of the enterprise, which is the outgrowth of the older and more populous localities. The mills of the Northwest, and as well those upon the lines of travel in the South, have, throughout the entire season, been utterly unable fully to respond to the demands which have been made upon them for railroad timber used in the construction of bridges, culverts, and depots, and with every railroad improvement the march of settlement has ever increased. During the last fiscal year, the government reports show an emigration from foreign lands of nearly five hundred thousand souls, whose demand for lumber, at the general average of five hundred feet to the person per year, will amount to two hundred and fifty million feet. This is in addition to the increase in the demand from the natural increase of our previous population, and, from present indications, will continue through a repetition or continuance of emigration for years to come. Meantime, our leading cities display an increased demand for wood products, in their expansion of growth and manufactures, while the growing population of the prairies and the Western mountains are building villages and creating new cities. Truly, this is a wonderful country, and we cannot but admire the beneficent provisions of nature in the adaptations of timber growth, as well as of minerals, to the sustenance and comfort of the people which is called so speedily to transform its wild and inharmonious elements into elements of grandeur, growth, and development.—*Northwestern Lumberman.*

The Sweet Potato Crop.

The *Tribune* obtains from one of the leading dealers in sweet potatoes in Washington Market, the following information in regard to the sweet potato crop of 1880: There is now no doubt that there will be an abundance of sweet potatoes this year. Along the east shore of Virginia, where most of the stock is now coming from, there was a large amount of ground planted, and the yield has been very good; the quality is excellent. Delaware "sweets" are just beginning to arrive, and there, also, there will be a good crop. It is probable that the crop generally will exceed that of last year. The Delaware tubers are considered the best, and the Virginia stock ranks next. A considerable quantity is raised in New Jersey, but they are of inferior quality, generally small, and cook unsatisfactorily. A large part of the Delaware crop is kiln dried every year to make them keep late in the winter. The crop is planted at different times, so that it matures about as fast as wanted during the fall. Farmers began digging some time ago, and will continue until November.

The bulk of the crop comes to market in sailing vessels, which hold from 500 to 1,000 barrels each. Large quantities also come by the Old Dominion steamers from Norfolk and Richmond. Others are shipped by railroad by the way of Baltimore. Sweet potatoes are generally packed for shipment in barrels with canvas tops. Holes are cut in the sides to admit the air, as they are more delicate than their Irish cousins and

easily decay. Sometimes they are shipped in bulk by vessels, but then they are less likely to keep well. Large quantities are reshipped to Albany, Troy, Hartford, New Haven, Providence, Boston, and lesser cities. At present the best sweet potatoes are selling at $2.50 a barrel, and common stock at $2; but dealers expect prices to drop to $1.50 a little later in the season. Plump, bright tubers will be found to have the best cooking qualities; those which are elongated and dark colored are always inferior. Efforts to raise sweet potatoes in New York and other Northern States have not met with much success. Some are raised in the West, particularly around St. Louis, and with these that part of the country is supplied.

What Machinery has Done for Agriculture.*

In visiting the fairs the observant person will be attracted by the usual brilliant display of agricultural machinery. It may be very well worth while, as he views these exhibits, to give a passing thought to the benefits which agriculture has derived from the genius and the labors of the mechanician. We may go back in thought to the time when the spade, the hoe, the sickle, and the flail comprised the farmer's store of machinery, and when the plow was the rudest contrivance, hardly worthy to be called a tool. Then every man tilled the soil or engaged in pastoral pursuits because it was all one man could do to provide himself and his dependents with food. Then each man was forced to clothe himself and be his own mechanic for this simple reason. He labored long and with infinite pains, and the ancient sentence that man should earn his bread by the sweat of his brow came home to him with unmitigated force.

In course of time improved and effective tools so lightened the labors of the agriculturist, and so increased his products, that the opportunity to make a division of labor arrived, because there was food to spare for the mechanic. And so this condition of things became more and more firmly established until it changed the whole social and political aspect of human affairs. And now what do we see? The use of the most effective agricultural machinery and the mechanical facilities for transporting these, now so cheapen products, that the whole social fabric of the oldest civilized nation of the world is threatened with revolution and reconstruction; and it is the reaper, the self-binder, the steam thrashing machine, the locomotive, the steel rail, and the steamship, that have, in their combined effect, brought dismay and dread to every man in Europe who lives on the fruits of the labors of his fellow men, the land owners who live upon rents. The true "landlord" is now not the owner of an English estate, but the farmer who commands an army of farmers, with brigades of plows, reapers, and other machinery upon the plains of Western America. He makes laws for countries thousands of miles away, and his products rule the world's markets. The genius of agriculture today is the mechanic; the soul of agriculture is the inventor. One farmer can now, with the help of machinery, feed a hundred men with greater ease than at one time he could feed himself alone. The farmer supports the railroads, for stocks rise and fall with the good and indifferent reports of what the harvest shall be. He supports lines of steamers with his wonderful freights of breadstuffs, provisions, meats, cattle, and sheep. He maintains the millions of artisans who clothe and shelter him and who provide for every one of his wants outside of the field.

The mechanical power of the age is like a series of concentric and eccentric circles, of which the farmer stands out in the principal center. These all revolve with and about agriculture, and the same force sets all in motion. It is the farmer's duty now to make the most of his opportunities. He should be the foremost man of the age. His influence should be felt everywhere. It is felt everywhere, for the wealthiest merchants and capitalists and the most active politicians all ask themselves how far the farmers can be depended upon, before they make a movement in their special pursuits. But the farmer should feel this himself. It is one thing to have power and another thing to be cognizant of the possession. Let the farmers consider now their position, and as they take a view of it let them consider what they owe to the power and influence of machinery.

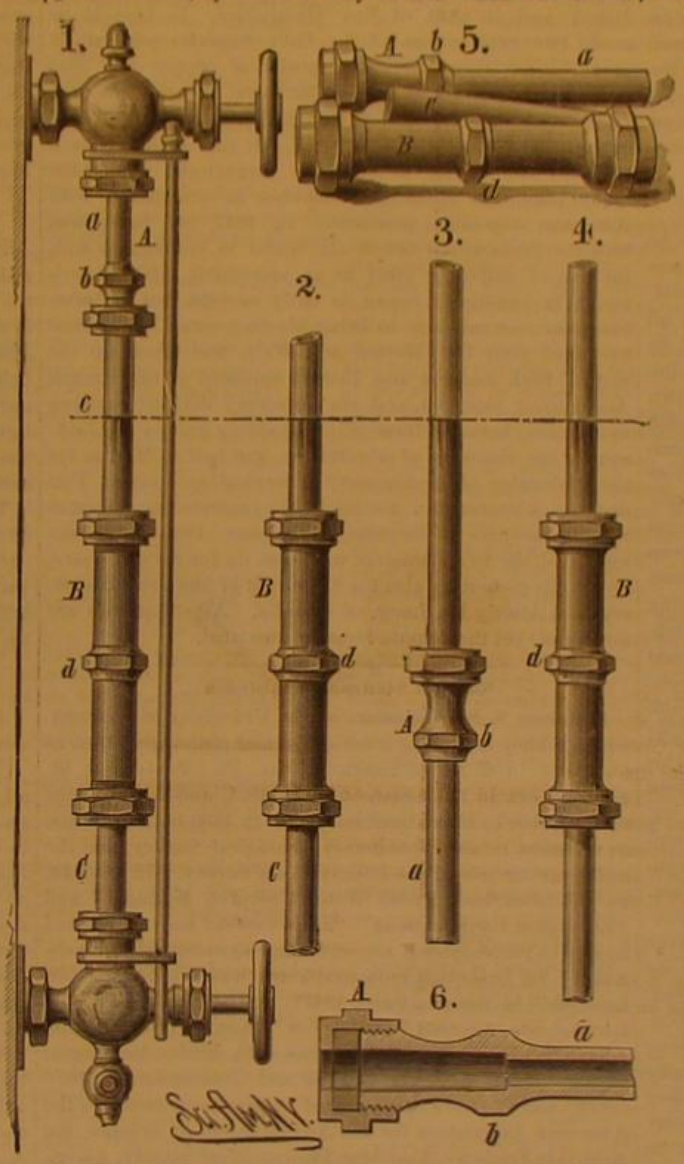
In conclusion, one most conspicuous example of the results pointed out may be noted. A few years ago Minnesota spring wheat was graded very low in the grain markets and brought a low price. Unfortunately for the Western farmers this grade of spring wheat was the only one they could produce. A "new process" in milling was introduced. Elaborate machinery was invented to perfect the process. The best wheat by this process was the grade known as "Minnesota spring," theretofore despised and rejected—literally "rejected," in fact, in the markets. Afterward this grade became sought by millers, and the value advanced to a point equal to and sometimes more than that of the previously much sought winter wheats. If Minnesota farmers produce forty millions bushels of wheat annually, this advanced value, due to the new process, puts several millions of dollars yearly into their pockets; and what a vast amount of comfort and happiness may be secured by the right use of so much money. Here we have but one instance only of the vast concatenation of circumstances which points the moral here alluded to.

*Henry Stewart, in the *Rural New Yorker*.

IMPROVEMENT IN WATER GAUGES.

A person unacquainted with steam and steam boilers can scarcely realize the trouble, occasioned by the breaking of water gauge glasses and the vexation experienced in trying to run a boiler properly after the last tube is broken and gauge cocks are to be depended on for determining the level of the water in the boiler. In some instances water gauge tubes last for a long time, but it more frequently happens that they occasionally if not frequently break, and the boiler rooms are few that cannot exhibit a pile of broken water gauge tubes. This breakage is not only the cause of a great deal of trouble, but it is expensive, and where tubes of the larger sizes are employed the expense is considerable.

The engraving shows a device recently patented by Messrs. Nunns and Clough, of West Cheshire, Conn., for utilizing broken water gauge tubes. This device is very convenient and may be applied in several different ways. It consists of three principal parts, A, B, and C. The part, A, has a tube, *a*, corresponding in size to the glass tube in connection with which it is to be used. It has a stuffing box containing a packing ring for receiving one end of the glass tube, and is provided with a fixed nut or hexagonal collar *b*, by which it may be held when one end is



NUNNS AND CLOUGH'S EXTENSION WATER GAUGE

being coupled. The part, A, is complete in itself, and may be used in connection with a piece of water gauge tube too short for use in the ordinary way, and its tube may enter either the upper or lower tube holder as may be desired.

The tubular piece, B, has a stuffing box at each end for receiving either two pieces of glass tube or a tube, *c*, of glass, and the metal tube, C, and in the middle of its length there is a hexagonal collar, *d*, for holding it while the stuffing boxes are adjusted.

As represented in Fig. 1, all of the parts, A, B, C, are used, the short section, *c*, of glass tube being sufficient to answer the purpose of indicating the water level. In this instance the part, A, is uppermost, but the order of the arrangement may be reversed. Fig. 2 shows the manner in which the tube may be lengthened by employing the parts B and C, the latter being capable of sliding more or less into the former.

Fig. 3 shows the glass lengthened by the application of the part, A, and Fig. 4 shows the part, B, used to connect two pieces of glass tube. Fig. 5 shows the several parts in detail, and Fig. 6 is a longitudinal section of the part, A, showing the construction of the stuffing box and exhibiting the enlarged portion into which the glass tube is inserted.

It will be seen that this device is capable of a great variety of applications, and it must be evident to engineers that at the price at which it may be afforded it will pay for itself over and over again in a short time.

These attachments are made in different sizes to suit the wants of different purchasers.

Further information may be obtained by addressing the Extension Water Gauge Company, Cheshire, Conn.; New Haven, Conn.; or C. N. Marcellus & Co., agents, No. 91 Liberty street, New York city.

Treatment of Burns.

Dr. Shrady, of this city, recommends that burns be treated by applying a paste composed of three ounces of gum arabic, one ounce of gum tragacanth, one pint of carbolized water (one part to sixty), and two ounces of molasses. The paste is to be applied with a brush, renewed at intervals, and is stated to be a successful method. Four applications are usually sufficient, the granulating surfaces being treated with simple cerate or the oxide of zinc ointment, as indicated.

The Exportation of Cattle.

The recent sailing of five ocean steamers laden with cattle from this port in one day, all belonging to or chartered by one firm, caused the *Tribune* to make special inquiry with regard to the present extent of the trade and the manner in which it is carried on. It appears that, in spite of the restrictions upon the movement of American cattle in England, the exportation of live cattle is superseding that of dressed meat. The shipments last season were 105,324 head; thus far this year the number has been 118,000. Besides these many shiploads are sent by way of Canada. New York, Boston, Philadelphia, Baltimore, Portland, and Montreal are the ports of shipment. New York leads; Boston ships two-thirds as many as New York; Philadelphia and Baltimore rank next, and both exceed Portland. The aggregate trade, including sheep, approaches $35,000,000 a year. The largest dealer in this city, Mr. T. C. Eastman, told the reporter that the trade in live cattle opened about four years ago. The trade in dressed beef began in 1875, and six months later the live cattle trade. The low freights on live cattle give that branch of the trade a decided advantage, notwithstanding the restrictions on the other side. Owing to the discrimination in favor of Canadian cattle, large numbers from the States are shipped by way of Montreal. Those go to the North of England, and are sent to the southern districts as Scotch cattle, bringing the highest prices. The same cattle sent from New York or Boston are not allowed to go out of the receiving depot, and must be slaughtered within seven days. The exported cattle come principally from Ohio, Kentucky, Illinois, Iowa, Missouri, Kansas, Nebraska, and Colorado. There are some cattle brought from Texas, but usually they are not so large or fine as the others. They are all slaughtered here and sent to Europe as dressed beef. Only the largest and finest animals are sent alive. The live cattle bring here from 9½ to 10 cents a pound for good shipments. Different dealers give prices ranging between $75 and $100 a head. The selling price on the other side was placed as high as 15 cents a pound.

The trade began experimentally in 1875, and no record was kept of the number exported. The growth of the business since then is shown in the following figures:

In 1876 the shipments amounted to 22,500, nearly all dressed carcasses. In 1877 the number had reached 60,000, of which number one quarter were live cattle. In 1878 the shipments were 95,600, of which 30,000 were live cattle. In 1879 the number reached 105,324, of which amount 33,295 were live cattle, and 72,029 dressed carcasses. For 1880, from January up to the first two weeks of August, the shipments were 64,843 live cattle, and 53,533 carcasses of beef—a total of 118,376.

HOW THE CATTLE ARE SHIPPED.—The method of shipping the cattle and other details were obtained from down-town dealers. There are several steamers, not belonging to any regular line, which are chartered as needed by commission merchants in this country to go to any part of Europe. These steamers average generally between 1,200 and 1,500 tons. One firm alone controls no less than thirty such unattached vessels. Besides these vessels, nearly every passenger steamer for Liverpool, London, and Glasgow carries a cargo of cattle, except on two lines. The cattle are shipped to Antwerp, Havre, Glasgow, and Deptford, which is about fifteen miles from London. The vessels taking cattle to England also carry general cargoes, which they discharge on the Continent after first landing their cattle. The reason for this is that there is a greater demand for small general cargoes on the Continent than in England, and vessels are not allowed to carry over their net registered tonnage on account of the insurance.

Cattle are taken on and under deck in stalls measuring 2 feet 8 inches on vessels sailing from New York, and 2 feet 6 inches on those from all other ports of the United States. These stalls are built under the supervision of an insurance inspector. The rate of freight this season has ranged from £4 15s. to £5 10s. a head, in advance. This rate includes covered room for necessary fodder and passage to destination and back for one attendant to every thirty animals.

During the summer shippers prefer to ship on deck, as the cattle get more air and come out fresher at the end of the voyage. On deck the steamships carry between 150 and 175 animals, and under deck about 225 head. Drinking water is condensed by steam process on board for their use, the ocean itself proving a never-failing source of supply. The rates are exacted in advance, as cattle are considered not so safe a risk as wheat and other commodities. The cattle are generally put on the steamer in the stream, after it has left the dock, an old ferryboat usually being used for the purpose. They are shipped at points all along the river front, from Sixty-fifth street to Pier No. 1, and even down

the bay, according to convenience. The number of cattle to be taken is regulated by the insurance inspector, and cattle exporters must pay the entire freight, according to his report, even if they do not ship the entire number.

Sheep and pigs are stowed in stalls on deck where there is not room enough for the cattle. Sometimes in the early spring, when the sea is liable to sudden disturbances, some of the cattle get overboard, and then a very lively time ensues in getting them out. The cattle are hoisted on board usually and lowered two at a time by a winch into the hold. The allowance of water is from six to ten gallons a day to each bullock. The amount of fodder averages one ton to each animal. The rates of insurance apparently vary. Some shippers give it as from 3 per cent in summer to 10 per cent in winter. There is more risk to the cattle from perils of the sea in the latter season, as a heavy storm may make it necessary to lighten the ship by throwing the entire deck load of cattle overboard. Shipments in winter are not very heavy, although last year a handsome profit was realized on a selected lot of extra fine cattle sent to supply the English with their Christmas roast beef. The New York shippers allow more space to the cattle than shippers at other ports. The carrying capacity of the vessels, of course, varies; but the average, as given by an old shipper, may be put safely at 200 head at a shipment, taking large and small vessels into account. On some of the larger steamers the number has reached 500, and one Boston steamer has carried as many as 841 head. The largest shipment from New York by one steamer was 650 head.

Science in Flour Manufacture.

Until recently it was believed that the only thing to be sought for in the production of a good article of flour was a more or less fine disintegration of the kernels of wheat. As long as millers held to the theory that grinding was all that was required, a large percentage of the flour had its nutritive powers greatly reduced by being ground to an impalpable dust. Science, by aid of the microscope, has shown that no really good bread can be made from flour in which any large portion of the starch globules have been thus broken down. The rising of bread is due to the starch globules which remain whole, while the dust from the disintegrated ones, by souring, impairs the lightness and sweetness of the loaf. It is but recently that these facts have been made known to millers, and since that time they have been discarding their old theories and machinery and devising improvements with the view to separating the starch globules, rather than pulverizing them. Another important advance in this industry consists of an improvement in bolting machines. Until recently the bran was separated from the flour by a powerful air blast, which blows off the light particles of bran. Considerable power is required for this process, and although it is carried on in a closed room, there is not only a great waste of the finer particles of flour, but the impalpable dust penetrates every part of the mill and often gives rise to destructive explosions. By a recent invention, electricity is made to take the place of the air blast. Just over the wire bolting cloth, which has a rapid reciprocal motion, a number of hard rubber cylinders are kept slowly revolving and rubbing against strips of sheepskin, by which a large amount of fractional electricity is evolved. Then, as the middlings are sieved by the reciprocal motion, the lighter bran comes to the top, whence, instead of being blown away by an air blast, it is attracted to the electrically charged cylinders, as light substances are attracted to a piece of paper, or a stick of sealing wax which has been smartly rubbed. The removal of the bran from the rollers, and its deposit on one side, are readily effected, while the flour is carried in another direction. The separation is thus made complete, with very little loss of dust. Still another device has been introduced, to remove from the wheat, before being ground, small pieces of iron, which, despite the utmost care, will find their way into the grain, working great injury to mill machinery. This trouble is now remedied by the use of a series of magnets, directly under which all the grain is made to pass. These magnets readily capture all the stray pieces of iron from the wire bands used in binding; and they have also revealed the singular fact that, of the scraps of iron and steel which find their way into the grain, fully one-third are something besides the binding wire. They are of larger proportions, of varying character, and much more hurtful to the machinery than the wire. Thus it is that science is constantly coming to aid all the varied industries, lightening the labor of the workmen, decreasing the cost of products, and in every way improving all the various processes which are involved in the improved and constantly advancing civilization of the age.—*The Weekly Astorian.*

Alarm Telephones.

A Chicago police officer suggests the addition of telephone boxes to the system of alarm telegraphs in use in our cities. In connection with the alarm a reserve force is to be maintained at the stations with wagons and ambulances, and all the paraphernalia necessary for riot or accident. Should it be a murder, robbery, or any other crime, the perpetrators of which have escaped, the alarm is to be given to every man in the district by sounding a large bell, which is to be placed upon the roof of the station. Upon hearing this, every officer on duty is to run to the nearest telephone box and correspond with the station; and it is also proposed that they report by the same means every hour, whether anything occurs on their beats or not.

Dr. Charles Thomas Jackson.

Dr. Charles T. Jackson, for many years one of the most active scientific men of this country, died at Somerville, Mass., August 29. He was born at Plymouth, Mass., June 21, 1805, and graduated in medicine at Harvard in 1829. Already he had directed his attention to geology, then an infant science, having been engaged with Francis Alger in a mineralogical and geological survey of Nova Scotia in 1827–29. He went to Europe to continue his medical and scientific studies, and while in Vienna, in 1832, he assisted in the dissection of two hundred victims of the cholera epidemic then prevailing, and published a detailed account of his observations the same year in the Boston *Medical Magazine*. At Paris he paid great attention to magnetism and electricity, and brought home an electro-magnet, galvanic batteries, and other apparatus. Conversation with Dr. S. F. B. Morse on the possibility of an electro-magnetic telegraph, during the homeward voyage, led to a claim on the part of Dr. Jackson that the essential features of the electro-magnetic telegraph, as patented by Morse in 1840, were originally invented and explained to Morse by him. In 1836 Dr. Jackson was appointed State Geologist of Maine; in 1839 he was commissioned State Geologist of Rhode Island; and, in 1840, of New Hampshire. In 1844–45 he made two explorations of the Lake Superior mineral regions, discovering the vast deposits of copper and iron which have proved so productive there. During the next two years he was engaged in the geological survey of government lands in the same region. He was at that time a frequent contributor to scientific periodicals, and made many important chemical researches in connection with American vegetable products. In 1847 his name was brought prominently before the world in connection with the use of sulphuric ether as an anæsthetic. His experiments in anæsthesia began as early as 1834, but unfortunately he took no steps to bring his discoveries in practical use until after Drs. Morton and Wells had taken up the work. Both Jackson and Morton appealed to the French Academy of Sciences, and the Academy divided between them a five thousand franc prize, awarding half to Dr. Jackson for the discovery of etherization, and half to Morton for the application of the discovery to surgical operations. This decision, however, did not settle the controversy. Morton refused his share of the prize, and a fierce discussion of the merits of the two claimants was kept up for several years, Dr. Wells contesting also for the credit of the great discovery, and latterly Dr. Long, of Georgia. All the parties are now dead, yet the dispute remains unsettled.

Samuel Stedman Haldeman.

Professor S. S. Haldeman, of the University of Pennsylvania, widely known as a naturalist and philologist, died at his home in Chickies, Lancaster Co., Pa., September 10. He was born in the same county in 1812, and early turned his attention to the natural sciences. In 1836 he was chosen an assistant in the New Jersey Geological Survey, and the next year he joined the Pennsylvania Survey. In 1840–44, he published his "Fresh Water Univalve Mollusca" and "Zoological Contributions." Since then he has contributed largely to philosophical, scientific, and agricultural journals. Among his important monograph are those on the "Genus Lehtoxis," in French (Paris, 1847); on the "Zoology of the Invertebrate Animals" (1850); on "Some Points in Linguistic Ethnology" (1849), dealing with Indian languages; on the "Relations of the English and Chinese Languages" (1856); and of above one hundred papers contributed to the American Association for the Advancement of Science, the AmericanAcademy, American Philosophical Society, American Philological Association, Academy of Natural Sciences, and many other learned societies of which he was a member. His work on "Analytical Orthography" won in England, in 1858, the highest Trevelyan prize over eighteen competitors. During recent years he has taken great interest in spelling reform.

A Chinese Funeral.

At the burial of Lee Wau, in Evergreen cemetery, Brooklyn, N. Y., the other day, some of the mourners cast into the open grave a few handfuls of earth, just as Christians do. Then began the curious part of the ceremony. Fagots of slow matches were bound together and planted in a basin of ashes and loose earth at the foot of the grave. On being ignited they sent up a fragrant smoke. Red candles richly decorated with figures in gold, blue, and green, were placed in a row near the fagots, and quickly burned down to the little sticks on the end of which they were fastened. The dead man's clothes, including a white shirt somewhat the worse for wear, a freshly laundered collar and handkerchief, a blue silk blouse, and a straw hat, were then rolled into a bundle and cremated near the grave, and the bright-colored and gilded wrappings of the candles and slow matches were added to the burning heap. A cocoanut mat was then unrolled beside the grave, and the Chinamen, coming up one after another, took a formal leave of the departed. This was done by clasping the hands, lifting them to the chin, and letting them drop, repeating the operation three times. After this the mourners dropped upon their hands and knees upon the mat, and made a triple salaam, bowing their foreheads close to the earth. Tea was poured from a quaint little pot of blue and white porcelain into minute cups of egg-shell china, and each man, as he bade farewell to the dead, sprinkled a spoonful of the tea upon the ground. Three pans of rice, a broiled chicken, and a plate of mutton were allowed to stand before the grave for some time, that the dead man might refresh himself and prepare for his long journey. It is customary to leave these dishes beside the grave, but just before the cortége returned, a Chinaman, whom opium had bleached, bleared, and sallowed into the resemblance of a corpse, gave a suspicious glance at certain of the small boys who had gathered about the place, and shuffled them back into a tea box whence he had taken them. Cigars were passed around, and then the yellow faces were once more shut up in the carriages, the drivers mounted to their seats, cracked their whips, and the procession disappeared rapidly in the dust.

AGRICULTURAL INVENTIONS.

Mr. Martin H. Woodruff, of Ellicottville, N. Y., has patented an improvement in the class of drag harrows that are rotated about the central pin or pivot as the harrow is drawn along.

An improved device to be attached to a corn planter for the purpose of planting or dropping corn at regular intervals, has been patented by Mr. Joel M. Shackelford, of Decatur, Ill. A beam is fixed rigidly across the front of the corn planter in front of the boxes, and has secured to it grooved rollers or pulleys for the support and guidance of the working rope, and fixed centrally upon the beam is a standard supporting a grooved driving wheel, around which the rope makes a turn as the planter is moved along. The rope being fastened at each end to a stake driven in the ground causes the driving wheel to revolve and operate the improved device.

Low Weaving Sheds.

It is claimed that the English method of building cotton mills but one story high is much more advantageous than the American method of placing floor above floor. In the low weaving shed with glass roofs used in England, an even and fine light falls on every loom; and the machinery, being placed on solid foundations, does not vibrate. Under our brighter skies it is doubtful whether glass roofs for skylighting would be of material advantage, and it is certain that they would not be comfortable for the operatives in midwinter or midsummer.

The question of vibration seems to be of more practical importance, especially if it is true, as our consul at Manchester says, that the most intelligent and competent mill managers in England have found it impossible for mills with looms on several floors to compete with those having the looms all on the ground.

Country Gains to Summer Visitors.

A newspaper correspondent moralizes over the closing season among the Catskills:

"One of the necessary preparations to the return home by all boarders is being weighed. Nearly every one expects to gain in weight, and nearly all do. The gain runs from two to ten pounds—averaging five pounds. For 50,000 people this would give the comfortable gross amount of 1,250 tons of fat added to New York and Brooklyn through Catskill sojourning. This is the net gain of the boarders—250 000 pounds of fat against $1,000,000, showing human adipose tissue to cost $4 per pound according to Greene and Ulster county rates. Many delightful homilies may be preached on this text—Fat $4 per pound."

We are inclined to think that the writer underestimates the quality and value of this increase of substance. Probably the most of it is not adipose tissue, but firm muscle and other tissues of vital importance in the human economy. A record of increase in strength through summer living among the hills would be worth having. The hotel keepers should provide lifting machines as well as scales.

New Style of Cotton Packing.

Reporting on a bale of cotton packed by the Cotton Economy Company, of New Haven, by the use of the Dederick hay press, Mr. Edward Atkinson, of Boston, says that it contained 105 pounds of cotton, pressed to the density of hard wood. It is claimed that such compression does not injure the fiber. The alleged advantages of this method of packing are the compactness of the bale, its easy handling, and the very small proportion of tare. The bale is bound with wire and protected by a light, cheap bag, which keeps the surface clean. A bale so pressed was soaked four days in a canal, the water penetrating less than half an inch.

Testimony of the Rocks.

From a small erratic block, wholly unlike the rock of Mount Washington, found on the summit of that mountain recently, Prof. C. H. Hitchcock infers that the glacial ice was deeper in that region than has hitherto been supposed. The bowlder resembles the rocks of Cherry Mountain; and if it was carried to Mount Washington by ice, as Prof. Hitchcock believes, Mount Washington must have been totally submerged by the ice sheet at some time during the glacial epoch.

Human Hair from China.

Among recent importations by a New York house dealing in Asiatic goods were ten cases of human hair from China, weighing in all 1,330 pounds. Chinese hair is dark and coarse, and is worth from 50 to 65 cents a pound. It is sold in bulk to the retail traders, who make it up into switches, puffs, frizzes, and other capillary adornments for the heads of female citizens of African descent.

Business and Personal.

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

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

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

(1) G. S. H. asks: What size boiler and boat would I want for engine 2 inch bore by 4 inch stroke, and what speed could I get from same? A. Boat about 12 feet long and 3½ feet beam. Boiler (tubular) about 18 inches diameter and 3 feet 4 inches high. Speed probably about 5½ miles.

(2) C. G. G. writes: At the West the harvest mites (jiggers) are a torment to women and children and to some men. We cannot go into our garden even without the necessity of lathering all over with soap and changing every garment from collar to shoes. Formerly these could be worn the next day, but Dr. Tanner has made mischief here as well as among the tramps, and now they live on, on a growing appetite. I wish to ask is there not something which we can apply to the person to keep them from biting us, so that we can go to our garden more than once a day. We have tried quassia, salt, and alum without effect. The form of a dry powder would be best, as it would be applied on a cool morning when it would not be well in bath. A. Dalmatian insect powder, applied in small quantities with a suitable bellows, is said to have proved effectual in keeping the insects away. Of course it is not intended that clothes thus salted should be worn constantly. Frequent bathing is indispensable.

(3) S. B. writes: A small class are studying chemistry at this place, and are anxious to learn the cause of combustion. Will you please tell us through the SCIENTIFIC AMERICAN? Some say we apply a match to carbon to increase the motion of its molecules, in order to bring the molecules of oxygen sufficiently near to those of the carbon to enable the atoms to unite; then all that is necessary to determine chemical union is to give the molecules the right motion to get them sufficiently near each other for cohesion to appear and draw them together. Others say that motion has nothing to do with it, but the atoms must be separated by heat and then they will clash together regardless of their motions. A. Combustion is a chemical reaction comprehending the direct union of two or more substances. Heat accelerates molecular motion, and in effect brings the molecules within the range of chemical attraction. In chemical combination it is not the force of adhesion, but of *chemism*, which determines and effects the reaction. Consult Cooke's "The New Chemistry," and Tyndall's "Heat as a Mode of Motion."

(4) S. H. H. asks: 1. What is the best book on the uses and seasoning of the timber of this latitude? A. We do not know of any work specially devoted to this subject. You will find some information in Knight's Dictionary under "Wood," etc. 2. What is the best style of small saw mill to attach to an overshot wheel of twenty-five feet diameter and from six to twelve horse power? A. A circular saw mill. 3. Would not an overshot be the best wheel for a small and variable water supply with twenty-five to thirty feet fall? A. Yes.

(5) R. F. H. asks (1) if air is compressed into a smaller volume, what is the rule to find the increased pressure and temperature of said air? A. The pressure is inversely as the volumes. If 10 cubic feet air is compressed to 1 cubic foot the pressure is 10 atmospheres, the temperature remaining unchanged. 2. If while so compressed the temperature of said air is lowered by radiation, does the pressure decrease, and if so, by what rule? A. Yes; see tables of temperature and pressure in scientific works. You will find a great deal on the subject of compressed air in SUPPLEMENTS, Nos. 1, 2, 22, 24, 176, 177, 182.

(6) E. U. writes: In looking over several numbers of the SCIENTIFIC AMERICAN I find the question asked how to make pencil drawings permanent. You recommend alcoholic shellac varnish. The following is better, and no trouble; Steam the drawing over boiling water, both sides. It will do for crayons or pencil. I have a pencil drawing that I treated that way 18 to 20 years ago, and it has had rough usage, but there is no rub out to it.

(7) G. S. H. writes: I am desirous of building a small steam yacht, just large enough to carry two persons (safely), guns, ammunition, and a small tent—in all weighing about 400 lb. I wish to get the proportions of the engine, boiler, boat, and screw, and I wish them proportioned in such a way that I can get the greatest possible strength and speed. A. It is probable that you would be suited with a boat about 14 feet or 15 feet length, 4½ feet beam, and 2 feet depth, with engine 3 inch cylinder by 3 inch stroke. Upright tubular boiler 24 inches diameter by 4 feet high. Propeller 22 inches diameter and 33 inch to 36 inch pitch.

(8) G. E. F. asks: How is "dope" or harness blacking made? A. 1. Molasses, ½ lb.; lampblack, 1 oz.; yeast, a spoonful; sugar, olive oil, gum tragacanth, and isinglass, each 1 oz.; and a cow's gall. Mix with 2 pints stale beer, and let stand before the fire for an hour. 2. Molasses, 8 parts; lampblack, sweet oil, gum arabic, and isinglass, each 1; water, 32; apply heat. When cold add 1 oz. spirit of wine, and apply with a sponge. If too hard place the bottle in hot water before using. 3. Black resin, 2 oz.; melt in a glazed earthenware pot and add 3 oz. beeswax, ½ oz. fine lampblack, ½ dr. Prussian blue in fine powder; stir well, take off the fire, and add sufficient oil of turpentine to form a thin paste. Apply with a piece of linen rag, and polish with a brush.

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

T.—A fine silicious clay—useful in the manufacture of some kinds of pottery and for polishing purposes.

COMMUNICATIONS RECEIVED.

Curious Fact in Natural History. By F. C. H.
On Absolute Temperature. By C. M. B.
Talking by Telephone Through the Human Body. By F. E. K.
On Motion. By H. S. B.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 31, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

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Each design to be accompanied by a clear and condensed written description of drawings and the proposed material of construction, under seal, and a sealed letter, giving address of the author, the name of the party offering the design not to appear on the drawings or to be attached to the description.

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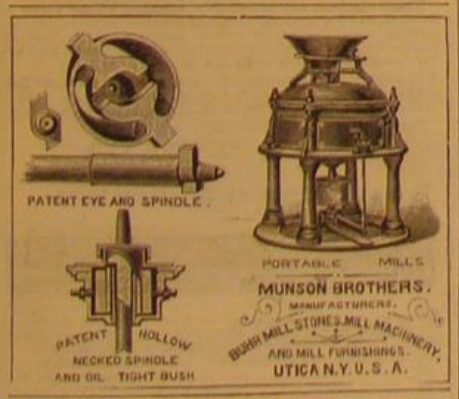
A. SCHREIBER,
Acting Chairman of Committee on Building.
H. G. HESTER, Secretary.



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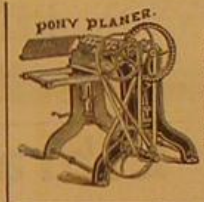

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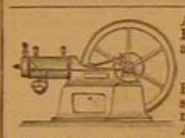

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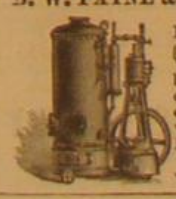

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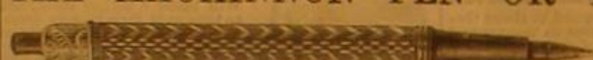

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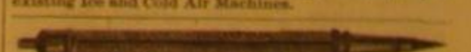

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Contents.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 249,

For the Week ending October 9, 1880.

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AMERICAN NAVAL DEFENSES.

In a recent number of the SCIENTIFIC AMERICAN it was shown that the City of New York could easily be reached by the shells of a hostile fleet either from the outer bay or from the open sea. This possibility in case of war can be met only by constructing ships for an efficient navy. It is not New York alone that is in danger, for nearly every important city on our coasts runs an equal or greater risk, and, although it might be possible to protect one city by concentrating there all our available force, it is too much to expect that any general security can be obtained until our navy receives a large addition to its strength.

Take Boston, for example. There are supposed to be ample fortifications to protect it, yet it is even more defenseless than New York. Lying at a distance of less than seven miles from the State House, a war ship would be entirely outside of the effective range of any gun mounted to defend Boston to-day. And even the heaviest guns that might be mounted on shore in the future could not give adequate protection to the city. A hostile fleet of ironclads could quietly anchor in five fathoms of water between Deer Island and Nahant and still be within six miles of the wharves and warehouses of Boston, while the nearest fortification now in existence would be two miles away—too far for even the heaviest guns to penetrate armor of twelve inches. There are guns already existing known to throw more than seven miles, and others are estimated (although not proven) to have a range of twelve miles; therefore, with such guns, ironclads could take up any position within this last-named distance and destroy Boston without being exposed to the least danger from shore batteries. Even though heavy guns be mounted on Long Island, Deer Island, and Nahant, the enemy could still occupy a position less than eight miles from Boston and be two miles distant from the nearest battery on shore. Portland is worse off than Boston, and Portsmouth is now equally helpless, although the Isle of Shoals might furnish sufficient protection if it was heavily fortified.

Turning to the Pacific coast, San Francisco might at first sight appear safe, being sheltered by hills varying in height from 300 to 1,000 feet. But, in reality, these elevations would be no protection whatever. The distance from the wharves in the inner bay to deep water on the other side of the peninsula is about six miles. A Krupp gun of 30 centimeters caliber, with an initial velocity of 1,500 feet, and an elevation of about 20 degrees, will give a range of six miles. The highest point of the trajectory with this elevation would be 2,965 feet, or a height far more than sufficient to clear the summit of Lone Mountain, which is about 1,000 feet high. At a distance of eight miles the vessels of the enemy would be out of danger from any guns on shore, and would have the whole city of San Francisco at their mercy.

But it is said by many persons that, in these days of civilized warfare, no nation would wantonly bombard a city of non-combatants which they never could expect to take. Inasmuch as such bombardments have frequently taken place in the past, it is perhaps too soon to assume that they will not occur again; but, admitting that a city like Portland might, on the score of humanity, escape such a visitation, there is no reason to expect the same immunity for New York, Boston, or Portsmouth. There are large navy yards in close proximity to these cities—navy yards which it would be not only the right but the duty of a hostile admiral to destroy in any way within his power. Now, at the distance from which the bombardment of the Brooklyn, Charlestown, and Kittery navy yards would take place, there can be no question that shells would fall promiscuously all about the neighboring cities.

But, even supposing that such accurate firing should be possible as to confine all the damage done within the limits of the navy yards themselves, can we afford, at the opening of a great war, to have our three principal navy yards destroyed? And yet, unless before such a war comes on, they are utilized to build war ships to meet the enemy at sea, they might just as well perhaps be destroyed. Public opinion would then be so effectually aroused that there would be some hope thereafter of having a naval force somewhat more in harmony with our importance as a nation. The inland States have such a preponderance of political power that all matters relating to naval and maritime affairs have failed to obtain, of late years, the attention that they deserve. Not only are people living in the interior indifferent to these subjects, but Eastern men in public life have also strangely ignored them; yet a powerful navy and an extended merchant marine are matters of as vital an interest to the farmers of the Western prairies as they are to the Eastern merchants. Give us a really formidable navy, and no nation in the world will willingly be drawn into a quarrel with us; leave our coasts unguarded, our commerce unprotected, and there is no third-rate foreign power that cannot in one year inflict upon us more damage than we, in five years, could retaliate.

A navy cannot be produced in a few weeks—especially if our navy yards are laid in ashes—and it is really astonishing that the business men of this country do not act more resolutely to induce Congress to give us a navy worthy of the name. The experiments of foreign governments have been sufficient to demonstrate in general terms the kind of vessels needed, and these should be built at once. The inventive talent of the country should also be encouraged by an annual appropriation for testing such valuable improvements on existing models as would maintain our prestige on the sea.

COMPRESSING AIR BY FALLING WATER.

Mr. J. P. Frizell, C.E., has recently given in the *Franklin Journal* a paper relating the results of some experiments made by him at St. Paul, Minn., upon the means of compressing air known as the *trompe*. The air is carried vertically downward in minute particles by a current of water which changes its direction to the horizontal, allowing the air then to rise to the top of the chamber through which the horizontal flow passes. At the falls of St. Anthony, in the Mississippi River, a shaft sunk some years ago was used for the experiments. This shaft was 36 feet deep, with clear dimensions of 6x14 feet inside. The apparatus consisted of a strong tank at the bottom of the shaft and two vertical channels rising to the surface. The one for the downward current of water had a section of 15x30 inches, the other, 24x48 inches. To supply the minute particles of air to the descending current, a siphon with small air holes was first used, but afterward the water was *aerated* (so to speak) by giving it a slight fall at its entrance.

In the tank the current was directed along the lower portion by a partition of plank placed 21 inches below the top. This partition was full of holes to enable the air to rise freely, and the space above it was called the air chamber. There was a hole at the level of the partition to enable the air to escape into the ascending shaft as soon as the air chamber was full, and made known this fact to the observers by the large masses of air rising to the surface. The capacity of the air chamber was 71·19 cubic feet. The difference of level in the surface of the water above and below the apparatus was 4·07 feet. But this head was greatly reduced for effective work as follows: Lost in fall to produce air bubbles, 1·000 foot; in resistance to movement, 0·443 foot; in slip, 0·653 foot; total, 2·096 feet; leaving only 1·974 feet available. But the effective power obtained by the experiments never exceeded 52 per cent of what it would have been if the water had been used directly to turn a wheel, nor do the experiments serve any practical purpose in showing the possibility of utilizing this means of obtaining power. Taking the formulæ as given by Mr. Frizell and applying them to a fall of 15 feet, only 76 per cent of efficiency is obtained, and with a fall of 30 feet only 81 per cent. Mr. Frizell's experiments are chiefly interesting as showing that this method of employing a waterfall is *not* economical nor practicable.

EMPLOYERS' LIABILITIES.

The tendency of legislation to throw safeguards around human life, and to hold railway corporations and others employing men in more or less dangerous occupations to the duty of making use of all available means to lessen the hazards of travel and labor, is well shown in the recent bill before the British Parliament, known as the Employers' Liability Bill. The object of this particular bill is "to extend and regulate the liability of employers to make compensation for injuries suffered by workmen in their service." It provides that in cases of injury resulting in death, the employer shall be liable, and the representatives of the injured party shall have the same right of compensation as if he had not been in the service of the employer. The limit of sum recoverable was first set at three years' earnings of a person in the same grade of employment in the district in which the injury was received; but in the House of Lords it was, on the motion of Lord Beaconsfield, reduced to two years.

By the terms of the bill the employer is liable for personal injury to a workman in cases where the injury is caused: (1) by reason of any defect in the ways, works, machinery, plant, or stock-in-trade connected with or used in the business of the employer; or (2) by reason of the negligence of any person in the service of the employer who has superintendence intrusted to him while in the exercise of such superintendence; or (3) by reason of the negligence of any person in the service of the employer to whose orders or directions the workman at the time of the injury was bound to conform, and did conform, where such injury resulted from his having so conformed; or (4) by reason of the act or omission of any person in the service of the employer done or made in obedience to the rules or by-laws of the employer, or in obedience to particular instructions given by any person delegated with the authority of the employer in that behalf; (5) by reason of the negligence of any person in the service of the employer who has the charge or control of any signal, points, locomotive engine, or train upon a railway."

New Discoveries on the New England Coast.

The United States Fish Commission's steamer Fish Hawk has made two dredging trips the past summer along the New England coast. The dredging was done chiefly between 150 fathoms and 325 fathoms, and the yield was immense. More additions were made to the marine fauna of New England than in the previous six years. The discoveries during the two trips were 30 crustaceans and 70 mollusks, more than half of them entirely new; also 33 species of fish, of which 12 are entirely new to science, representing four or more new genera; and 27 were strangers to the fauna of New England.

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THE HUDSON RIVER TUNNEL.

In our paper for September 18 we gave an engraving showing in section the construction of the new diving bell, or caisson, employed by the Tunnel Company to recover the bodies of the lost workmen and repair the damages occasioned by the crushing in of the tunnel entrance. In connection with the same figure, we now present another engraving, Fig. 1, showing the caisson in position and fairly at work, it having been successfully sunk nearly to the depth of the tunnel arches.

The accident, by which the entrance portion of the tunnel at Fifteenth street, Jersey City, caved in, took place on the 21st of July last. Twenty men who were at work in the structure lost their lives. The company attempted to recover the bodies by sinking a coffer dam, but the expedient failed, and resort was had to a diving bell or caisson, which machine is here illustrated. It consists of a great box of timber and iron, closed and made air tight, except at the bottom, which is open. Rising from the center of the box is an iron air flue, through which the men and materials are passed, and compressed air is introduced. The interior working chamber is of cylindrical form in its ceiling, is 41½ feet long, 25 feet wide, and 18 feet high. The roof of the chamber is composed of strong timbers, heavily braced and filled in solidly with cement, which is carried up to a level, forming a deck on which the necessary sinking load is placed. The ends and sides of the caisson are built of planking, held in place by strong timber cross braces and iron tie rods, running from end to end and from side to side, through the air chamber, as shown in our engravings. This is believed to be the largest air chamber or caisson of the kind ever produced. The men work in an atmosphere of compressed air, which, at the date of writing, was 11 lb. per square inch, but which pressure will be increased the deeper the caisson sinks.

The method of sinking is as follows: The men dig away, little by little, the earth at the outer edges, or shoes, of the caisson; at the same time weights are piled upon the flat upper deck on the exterior of the machine to overcome the interior air pressure and cause the machine to descend. In this case railroad iron is used as the weights. The pressure of air within the caisson prevents the rise of water through the ground where the men are at work, so that the floor of the working chamber is comparatively dry. The compressed air to a certain extent escapes at the edges of the chamber and bubbles up through the earth and superincumbent water. The earth that is excavated by the workmen is thrown into a box and mixed with water, and when made into the proper consistency, it is carried up out of the air chamber to the surface of the ground by means of a pipe, through which it is driven by the force of the compressed atmosphere that exists within the chamber. The caisson is kept in vertical position by means of suspension rods, that extend from the outer edges of the caisson to strong timbers at the surface of the ground, the upper extremities of the rods being provided with screw nuts, which are turned to permit the descent or adjustment of the caisson. The upper end of the central air tube is provided with a lateral extension, shown in Fig. 1, called the air lock, where the men go in and out. The air lock has strong doors at each end; one door is opened and the other closed, when the men go in or out, and thus the escape of air is prevented.

In Fig. 1, the place where most of the unfortunate workmen were buried, is indicated by the crushed iron plates that formed the original roof of the tunnel entrance. In both figures the two tunnels shown represent the mouths of the portions of the twin tunnels already built, which tunnels will form the main lines of the railway under the Hudson River. When the caisson is fully sunk home it will occupy the position shown by the dotted lines. A single broad arched tunnel will then be built within the caisson, as indicated in Fig 2, to inclose the mouths of the twin tunnels; and the single tunnel will extend thence on a proper grade to the surface of the ground in Jersey City.

At the time of this writing the working success of the new caisson had been apparently demonstrated, contrary to the predictions of outside engineers, who prophesied that it was too weak in construction and must inevitably collapse when subjected to the pressures involved in its descent. No sign of weakness has, however, appeared, and the machine has gone down nearly to its final resting place. Some of the bodies of the lost workmen have been recovered. The first to be taken out was that of the brave Peter Woodland, the assistant-engineer.

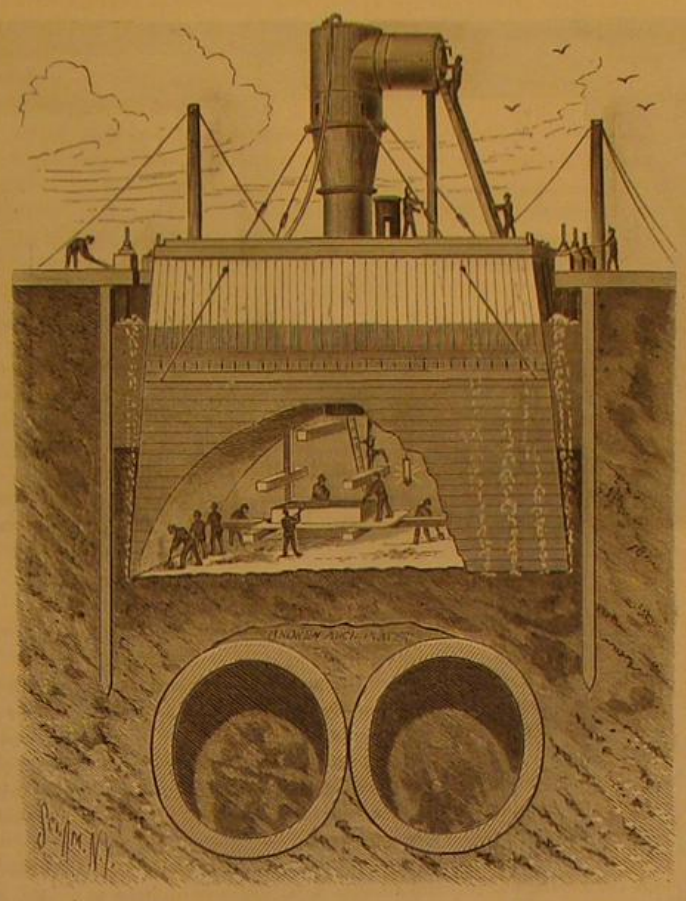


Fig. 1.—THE NEW CAISSON.—HUDSON RIVER TUNNEL.

THE LANDING OF THE OBELISK.

The transfer of the obelisk from Clifton, Staten Island, to the staging prepared for its reception at the foot of West Ninety-sixth street, has been delayed owing to the prevalence of strong northerly winds.

The method adopted for removing the monolith from the hull of the Dessoug was substantially the same as the one employed in loading it. The Dessoug, carrying the obelisk, was drawn out of the water in the cradle of Lawler's marine railway at Clifton. Then her bow was opened and the obelisk was run out upon a staging resting on two rows of piles driven for the purpose.

The reloading of the obelisk upon the pontoons to be used in floating it across the harbor will be accomplished as follows: The water will be pumped out of the pontoons which have been floated under the obelisk and sunk. In rising the pontoons will lift the stone from its temporary resting place, and a couple of tugs will tow the much-traveled monolith one stage further toward its final destination.

From the landing the obelisk will be hauled to the Park on a sort of portable tramway by means of a movable steam engine. The stone will roll upon cannon balls placed in the grooved tracks of the tramway.

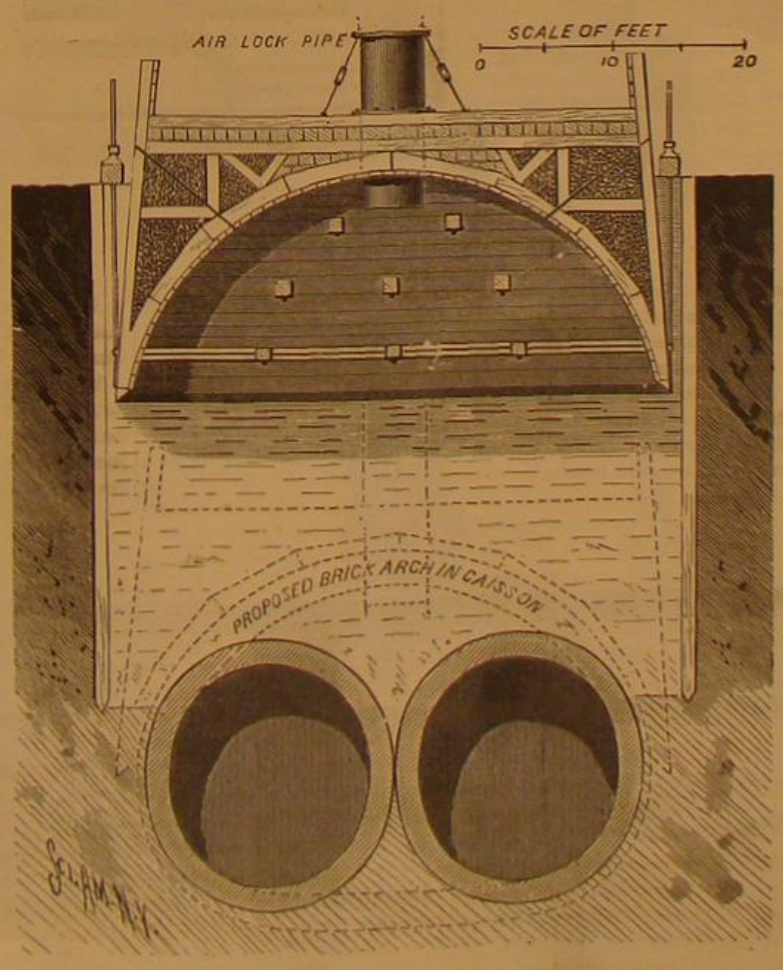


Fig. 2.—THE NEW CAISSON.—HUDSON RIVER TUNNEL.

BENZINE is said to be more effective than anything else for exterminating moths, roaches, etc.

The International Roadmasters' Association.

The second annual convention of the International Roadmasters' Association met in Chicago, September 8. The subjects of reports and discussions embraced track frogs and switches, the comparative action of frost on different material composing roadbeds, heaving, and the utility of tile and deep ditching; ballast and its preparation; track-laying; best forms of spikes, joints, nut-locks, rails, rolling stock, etc.; elevation of curves; and the relative merits of different kinds of ties.

The committee on track frogs found that the frog that gave the best results was the steel-rail spring frog always open for main track, for the reason that it was the safest for trains running at a high rate of speed, it gives no jar to rolling stock, is the least injurious to wheels and springs, its durability is greater than any open or rigid frog, costs less to keep in repair, and costs no more than any other steel-rail frog per foot. The committee also found that the steel-rail rigid frog, with wrought or rolled iron filling between point and wing rails, gave the best results in large yards where switch engines were constantly working.

The discussion of roadbed materials resulted in the decision that with proper drainage a good roadbed may be made of gravel, locomotive cinders, slag, or broken stone, either material to be used according to the cost at which it could be obtained in the particular section where it might be required.

The committee on railway curves and their elevation recommended the following:

1. That the limit of elevation of all curves should be five inches.
2. Changes of elevation on all old roads should be made by raising the outer or lower rail, as the case may require.
3. That the proportion of elevation at the tangent point to maximum elevation should be one-half.
4. That the rate of elevation on all curves, with speed at thirty-five miles per hour, should be three-quarters of an inch to a degree.
5. That in approaching a curve the rate in change of grade to get the necessary elevation of tangent point should be 1 inch to 100 feet.

The third recommendation was, after discussion, amended to make the proportion of elevation three fourths. The committee on switches, after expressing their personal favor for the Wharton and split switches as the most safe and economical, resolved to recommend no particular form of switch. The best switch would be one that came the nearest to an unbroken or continuous rail on main line and sidings.

A number of prominent roadmasters discussed at some length the proper size and weight of rails, but no decision was arrived at. The association will meet next year in Cincinnati, the second Wednesday in September.

Industrial America Abroad.

The *Tribune* recently announced the shipment of brush and broom making machines to the Holy Land by a Schenectady firm. They were for the American colonists at the foot of Mount Carmel. A short time ago the cable announced that an American mowing machine had taken first prize in a trial on the fields of Bulgaria. Simultaneously from Australia came the announcement that an American watch had been awarded the highest premium at the fair in Melbourne. Europe and the East does its weighing on American-made scales. A correspondent in Paris gave lately an account of the introduction of American elevators in hotels there. American hotel palace cars have been introduced in England in spite of English prejudice, and will soon overcome the opposition to their introduction in France which the parsimony of French corporations maintains. Our breadstuffs are sold in every market of the hemisphere; and special fleets of steamers convey live American beef to English markets. Every variety of canned goods finds favor there.

These are only a few of the facts which might be named in illustration of the recent material development of America abroad. The growth of our industries has not been confined to home; marvelous as it has been in the last decade or two, it has been equally surprising in the older countries. A few years ago American pork and cotton were about the only staple productions which Europe largely bought of us; now there is a large trade in nearly every article of food grown or machinery invented in America.

The Largest Lathe.

The St. Chamond Steel Works, France, boasts of having the largest lathe in the world. It was manufactured by Sir Joseph Whitworth & Co., of Manchester, England, and has just been set up in France for turning 100-ton guns.

RAILWAY IMPROVEMENTS.

The annexed engravings represent improvements in grain car doors, and in railway draw bars, recently patented by Mr. Thomas Hibbert, of Cochran, Ind. The car door is designed for application to ordinary box cars to adapt them to the transportation of grain. It is arranged so that it closes the lower half of the doorway when the car is to be used for grain, and swings up out of the way when the car is used for goods. The door, A, fills the lower half of the door opening, and is cut away at the free end and fitted to the flanged guard or stop, D. The opposite end of the door is pivoted to a bar, B, which, in turn, is pivoted to a post secured to the side of the car. The bar, D, carries a projecting pin which engages a curved guide, C, fastened to the vertical post and to the floor of the car. This guide keeps the door in its place and prevents it from being lifted out of its place, when closed and locked; it also protects the door against injury when the car is packed with goods.

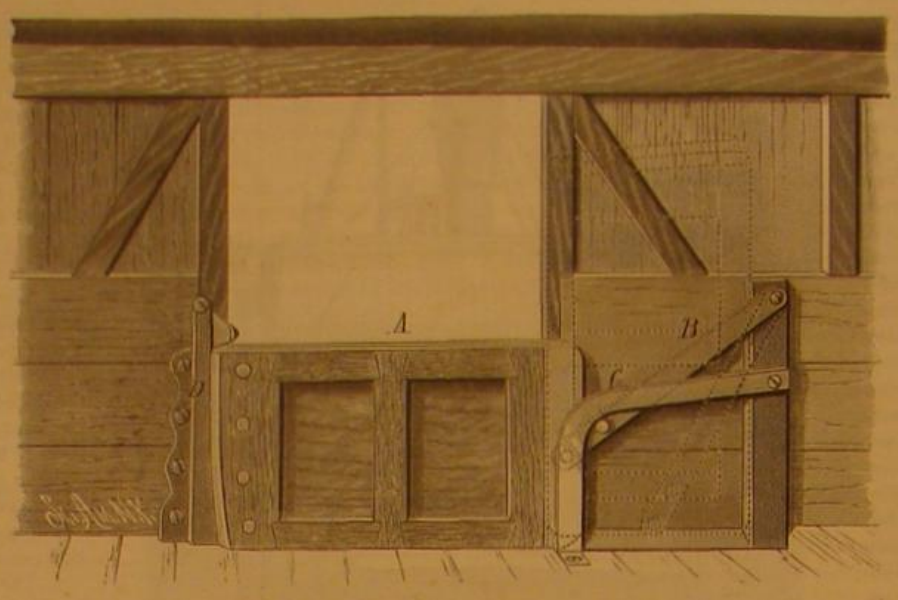


Fig. 1.—HIBBERT'S GRAIN-CAR DOOR.

When in use the door occupies the position shown in the engraving, and its free end is fastened by an eccentric latch at the top of the guard, D. When the door is not in use it is raised up out of the way as shown in dotted lines.

The continuous draw bar, shown in Figs. 2 and 3, is arranged so as to take the longitudinal strain off the car and thus dispense with one of the greatest causes of destruction to railway cars. The drawhead, A, is slotted to receive the crossbar, B, and its inner end, D, is guided between parallel timbers, C, that extend the whole length of the car. The outer end of the drawhead is supported by a stirrup in the usual way, and the inner end passes through a follower, which is pressed outward by two spiral springs, E, which are properly supported and guided in the framework attached to the bottom of the car. The arrangement of the draw bar is the same at each end of the car, and the two crossbars, B, are connected by two draw rods, F, which extend parallel with the central timbers of the car throughout its entire length. When the draught is applied by the engine the strain is transferred through the draw rods, F, to the rear end of each car of the train, thus relieving its frame of all stress lengthwise, owing to the yielding of the buffer springs at the rear end of the car and the abutting of the follower against the extremities of the buffer beams or blocks. In backing, the drawheads are pressed inward, the followers pressed against the ends of the timbers, C, and the springs are pressed back into their recesses, when they are relieved of further compression.

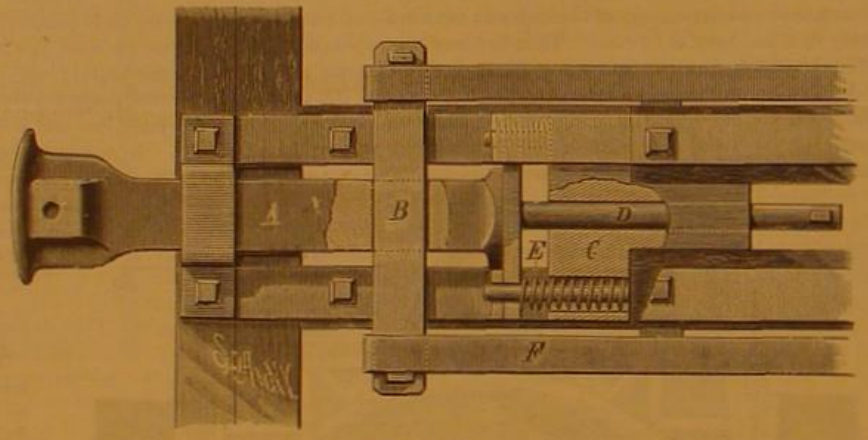


Fig. 3.—DRAW BAR.

In backing the train the inward movement of the drawheads occurs without bending the rods, F, as the latter are slotted to admit of the movement of the crossbar, B.

Should the rods break, the drawheads are prevented from pulling out of the frame of the car by means of a key, extending through the inner end of the heads behind the followers; the strain is then transferred to the brackets in front of the follower. For further information in regard to these practical and useful inventions address the inventor as above.

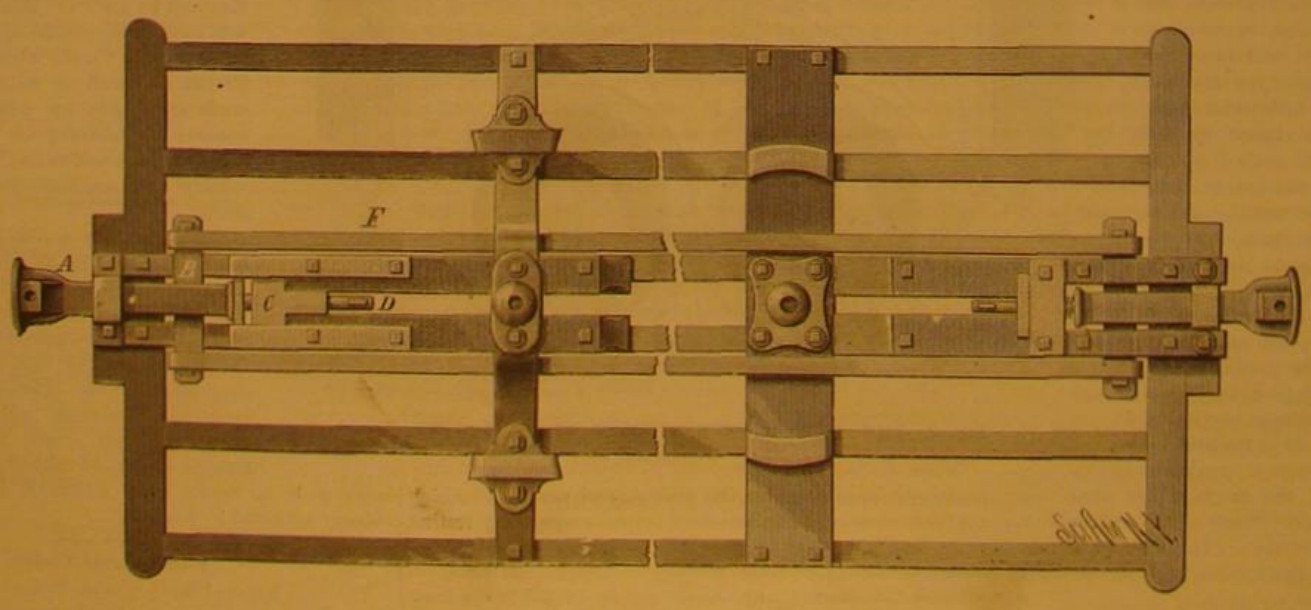


Fig. 2.—HIBBERT'S CONTINUOUS DRAW BAR.

Spontaneous Combustion of Coal at Sea.

An explosion, the result of fire by spontaneous combustion of coal in one of the bunkers of the Anchor Line steamer Alsatia, lately, compelled that steamer to return to this port. No great damage was done. The occurrence, however, calls attention to a source of danger to steamers of which we fortunately hear but little on this side of the ocean. The loss of English vessels by the spontaneous combustion of coal carried in bulk as freight, became at one time so frequent as to call out a special parliamentary commission of investigation, one curious result of which was the discovery that the burning of ships at sea was largely attributable to the working of the compulsory education act. The fires were caused by impurities (pyrites, etc.) in the coal. Boys had been employed at the mines to throw out such impurities. The new education law compelled the boys to go to school. The coal was not picked over. The sulphurets oxidized, smouldered, and took fire on ship board, and many ships were lost.

Certain Nova Scotia coals are said to carry sulphurets enough to occasion their spontaneous combustion; and some Pennsylvania bituminous coals have similarly taken fire in piles exposed to dampness; but there is no instance on record of the loss of a vessel through the spontaneous combustion of American coal. It is commonly believed that abundant ventilation will prevent the loss of coal ships at sea by this cause; but the parliamentary inquiry above referred to discovered that the better the ventilation of the cargoes, especially in hot and moist climates, the more frequent the fires.

American Architectural Tiles in England.

A correspondent informs us that at a recent exhibition at Crewe, England, of the London, Manchester, and Liverpool Agricultural Society, the first prize, gold medal, was awarded to J. & J. G. Low, of Boston, Mass., for the best art tiles in relief and intaglio. The progress of our countrymen in manufactures involving decorative art is very gratifying, and the special example here mentioned shows that the admirable methods of practical art instruction, now carried on in various schools in Boston, are beginning to produce useful results.

River Improvements.

Pittsburg sometimes ships by the Ohio River in one day more coal than would fill a train of cars 300 miles in length. All the coal used within forty miles of the river, from Pittsburg to New Orleans, is shipped out of the Allegheny and Monongahela Rivers in barges, and low water in the fall, followed by a frozen river, sends coal up several hundred per cent even in those Ohio River and Mississippi River cities that have coal mines within fifty miles of them by rail. So much cheaper is transportation by water than by rail, that the savings on the coal shipped from Pittsburg in the last ten years would have paid for the building of a railroad on the bank of the river all the way from Pittsburg to New Orleans. Poor as the navigation of the Ohio River is, its permanent suspension would destroy Pittsburg, and inflict upon all the Ohio River towns a damage which could not be repaired by a hundred million dollars' worth of railroads. France is peninsular, with the sea on both sides and not far away from her center; yet she finds her inland waterways indispensable to her prosperity, and capable of saving her more money every year than all her railways. She is preparing to extend her inland waterways at a vast expense, as a measure of economy, because they carry at a profit shipments which railroads cannot carry at all. The time is near at hand when the navigation of the Missouri River will save the people of its valley more money every year than all they now receive for their crops, and it will create lines of commerce and develop wealth which must lie dormant so long as we have to depend altogether upon railroads. Let our people come to the River Improvement Convention in this city, and take up its work in a practical way, and they will effect an emancipation that will free more laborers than that which Lincoln proclaimed in 1862.—*Kansas City Mail.*

RECENT INVENTIONS.

Mr. Alexander Atkinson, of Winterset, Iowa, has patented a simple and effective device for washing clothes and afterward wringing them without moving them from the tub.

Mr. John Herman, of New York city, has patented an improved suspender brace formed of two shoulder straps connected on the back by a transverse strap, each of the shoulder straps being attached at both ends to a separate hook plate, upon which a ring or eye of a pulley or like device catches or takes, and through which pulley a cord terminating in three button loops passes.

A simple and convenient device for holding and fastening the end of a rope has been patented by Messrs. Lester J. Bailey and Leander H. Thompson, of McPherson, Kansas. The invention consists of a snap hook having a swiveled hook or loop and a tubular internally threaded shank, into which is screwed a tapering clamping sleeve that is constructed in longitudinal sections and is provided with interior projecting points.

A stop cock, so constructed that the plug can be readily fastened and released, has been patented by Mr. Charles H. Cushing, of Tidioute, Pa.

Mr. Benjamin Maillefert, of Astoria, N. Y., has patented an improved process of and apparatus for refrigerating and making ice, in which the compressed air from a pump passes through a cooler which is supplied with a constant stream of cold water, from whence the air passes to a chamber, in which it expands in presence of steam supplied in a jet, bringing the air and particles of moisture into intimate contact.

An improvement upon that class of mortise or box door latches in which the door is securely latched whenever it is closed without the turning of knob or handle has been patented by Mr. Lorenzo Wallace, of Leavenworth, Kan

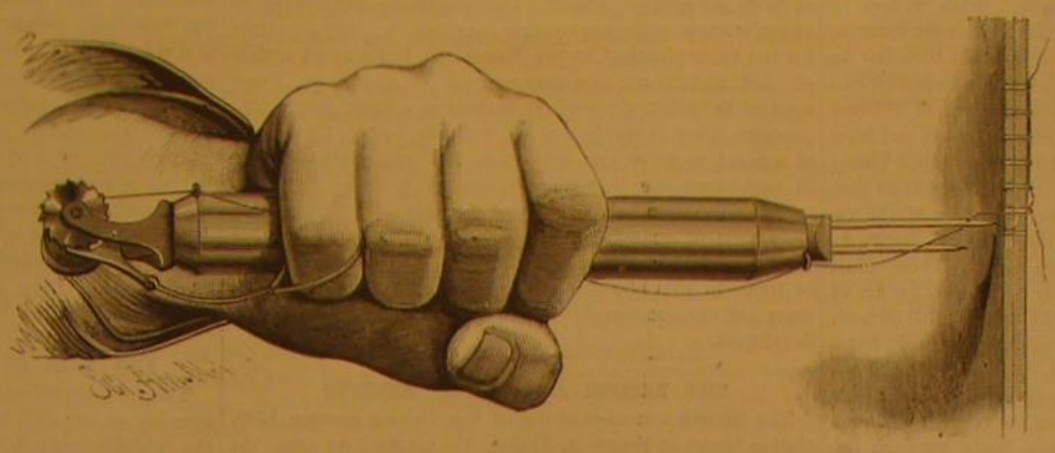
Mr. George M. Arnold, of New York city, has patented an improved device for administering medicine, etc. It consists in a bowl with a bent stem.

NOVEL HAND SEWING TOOL.

The engraving shows a novel tool for hand sewing recently patented by Mr. J. P. Council, of Council's Station, N. C. In using this tool a hole is first made with the awl, which is then withdrawn, and the threaded thread carrier introduced, the awl at the same time making a second hole, and so the work continues, the carrier following in the holes made by the awl. As the carrier, having carried the thread through the hole, is withdrawn, the thread forms a loop through which a threaded spindle is passed, and then the carrier is wholly withdrawn to close the loop upon the thread from the spindle, and in this manner the stitch is made.

As this tool is used the thread will freely unwind from the spool whenever it is required, and the operator, by keeping one of the fingers on a loop attached to the pawl, can at will permit or check the revolutions of the spool.

This tool is used when fine and accurate work is required. The awl makes a hole whenever the thread carrier enters the preceding one, consequently the holes are all made at equal distances apart, and the stitching presents a neat appearance.



HAND SEWING TOOL.

Pipe Lines for Tan Liquor.

In view of the exhaustion of bark in the neighborhood of large tanneries, and the cost of hauling such bulky material from distant woods, it is proposed to connect tanneries with good bark locations by means of pipe lines. Grinding mills and leaching tanks could be set up where the bark is produced, and the tan liquor conveyed to the tanneries through pipes of wood or lead. Iron pipes would not answer, as the tan liquor would corrode the iron and become blackened. The cost of pipe lines of four-inch bored logs is estimated at $1,000 a mile. It would thus be cheaper to bring the liquor to existing establishments than to move the tanneries.

Composition of Diastase.

The elementary composition of diastase has been determined by Zulkowski; he extracted it from malt by glycerol, and then precipitated it by alcohol; it was purified by repeated washings with alcohol, and was redissolved and reprecipitated several times. Eventually a product perfectly soluble in water was obtained, which had the following composition:

Carbon	47·57
Hydrogen	6·49
Nitrogen	3·16
Oxygen	37·64
Ash	3·16
Sulphur	traces.

American Wheat in Russia.

Russian journalists appear, says the London *Telegraph*, to be just now painfully exercised by the announcement that two American steamers, laden with grain, have entered the port of Revel for the purpose of discharging their cargoes, a circumstance hitherto without precedent in the annals of Russian commerce. That Russia would never need to import cereals from foreign countries has heretofore been a firmly established article of popular faith throughout the Czar's dominions. So rapid, however, has of late years been the falling off in productiveness exhibited in the agricultural districts of the empire that the seemingly impossible has at length come to pass, and Northern Russia is importing wheat from the United States. It is but justice to the Russian press to acknowledge that it has been profuse of warnings with respect to the probable consequences of slovenly and unintelligent farming, persistence in old-fashioned and exploded systems of cultivation, reluctance to invest capital in modern agricultural improvements, absenteeism, and other laches which have practically disqualified Russian grain growers from competing for foreign custom with their transatlantic rivals. But Russian buyers and peasant farmers alike were so immutably possessed by the conviction that Russia was the predestined granary of Europe that they calmly ignored these salutary monitions. They are now stricken with amazement and consternation by proof positive, such as is afforded by the importation of American grain into Revel, that the cereal yields of Northern and Central Russia no longer suffice to meet the consumptive requirements of the native population. Germany, too, is giving to America the preference over Russia for what grain she finds it necessary to import from abroad, on the reasonable grounds that the American wheat is at once cheaper and of better quality than the Russian. On the whole, Russian agriculture is just now at an extremely low ebb, and its future promises to prove even gloomier than its present.

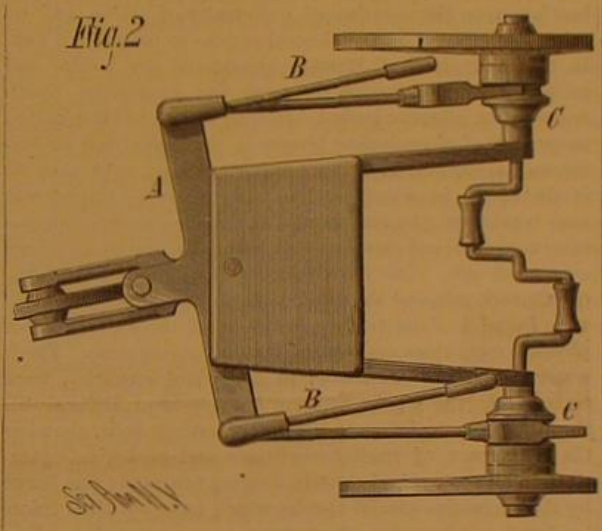
Sick Horses in Boston.

Not a little inconvenience and alarm have been caused in Boston by a recurrence of the distemper which was so fatal among horses in 1872. Hitherto the deaths have been few, but the disease is rapidly spreading, and in the large stables of express companies, omnibus and horse railroad companies, and the fire department, a large portion of the horses are sick. The disease is described as a specific epizootic fever of a low type, accompanied by inflammation of the throat and air passages.

IMPROVED VELOCIPEDE.

The bicycle has been perfected in mechanical details, and is now well adapted to the purposes of locomotion, as indicated by the large and rapidly increasing demand for them in this and other countries. It seems, however, that while a great deal of inventive talent and ingenuity have been exhibited in perfecting these carriages for men and boys, most of the efforts thus far made toward adapting a similar machine to the needs of ladies and girls have not proved satisfactory. The chief objections brought against these machines are the position of the rider, the unnatural action of the muscles in propelling them, and the difficulties connected with guiding the apparatus.

The invention shown in the annexed engravings overcomes these difficulties and gives the rider a graceful and natural position, admits of the free use of the limbs in propelling the carriage, and affords a perfect and easy control of its direction. The difficulties heretofore experienced in guiding a carriage having one or both crank wheels fixed to the axle has been effectually overcome by the inventor, and the rider, as she supports herself and guides the carriage by the same movement, releases the wheel making the inner curve, whether running forward or backward, and sets both rigidly on the shaft when running straight ahead.



PERKINS' VELOCIPEDE.

The plan view, Fig. 2, shows the arrangement of the various parts. The caster wheel, A, is operated by two handles, one at each side of the rider, and the swinging bar attached to the caster wheel support is connected with two shipper rods, B, which are capable of engaging with the clutches, C, on the crank axle.

Whenever one of these shipper rods is thrown forward by the movement of the guiding handles the wheel on that side of the carriage is released so that it may run loose on the axle. Further information may be obtained by addressing the patentee and manufacturer, Mr. N. S. C. Perkins, Norwalk, Ohio.

PERKINS' VELOCIPEDE.

MISCELLANEOUS INVENTIONS.

An apparatus for use in connection with a scale, or applied to a scale beam, for the purpose of multiplying the weight as indicated by the position of the poise, by any desired figure of a fixed gauge, and indicating the result in figures, has been patented by Mr. Charles E. Allen, of Mansfield, Pa.

An improved rudder for vessels has been patented by Mr. Frank G. Mareglia, of Lussinpiccola, Austria. The object of this invention is to provide sailing vessels with means for steering, whereby the course of the vessel may be changed without making leeway; also to provide for shipping and unshipping the steering devices when not required for use.

An improved velocipede has been patented by Mr. Henry Schlüter, of Stapleton, N. Y. The object of the invention is to connect the saddle and stirrup levers of a velocipede with the cranks of axle in such a manner that the dead-point shall be avoided.

Mr. William Robinson, of Bodega (Smith's Ranch P. O.), Cal., has patented a gate so constructed that it can be opened by the wheels of an approaching vehicle, by persons upon horseback or on foot, and which is operated by a positive movement.

Mr. John P. McDermott, of Galveston, Texas, has patented a telephone which enables one to hold conversation in any position and listen without inconvenience to lectures, etc., without others in the vicinity hearing, and to prevent other sounds from interfering with those to be heard, and at the same time allow absolute freedom of the hands when speaking and hearing.

Mr. John Collins, of Brooklyn, N. Y., has patented a compound for lining gas generators, acid chambers, and fountains for mineral waters, the use of which will avoid the expense and labor involved in the ordinary method of lining said vessels.

A method of laying underground telegraph wire, and forming conduits therefor progressively, which consists in laying cement or concrete in a trench around a tubular core or mandrel containing the wires, and sliding the core forward upon the wire as the conduit is completed, has been patented by Mr. Seth E. Codding, of New Bedford, Mass.

An improved mechanism for converting reciprocating into rotary motion has been patented by Mr. Tommaso Donato of New York city. The invention consists in a rocking lever having one or two segmental racks attached thereto, which act upon sliding racks having a connecting rod of a crank pivoted between them, whereby the reciprocating motion of the rocking lever is converted into rotary motion, and the power is greatly augmented by the difference in the leverage of the rocking lever and the segmental racks, and is then transmitted to driving wheels by intermediate geared wheels.

Messrs. Alonzo H. Kimball and Charles H. Kimball, of Littleton, Mass., have patented a road scraper and grader so constructed that it may be readily adjusted to cut the ground to any desired depth, to give any required crown to the road, to move the soil without becoming clogged, and which is held firmly against side movement.

Mr. Albert Wilcox, of Clarence, Iowa, has patented an improved clamp for harrow frames, which saves labor in the construction of harrow frames and avoids weakening the bars of the frames in securing them together.

A RESULT OF THE MISSISSIPPI JETTIES.

As a direct result of the success of Captain Eads' jetties at the mouth of the Mississippi River, is noted the present remarkable demand for huge grain carrying barges for the transportation of wheat from St. Louis to the ocean-going vessels at New Orleans. This demand for barges is supplemented by the recent purchase of several of the most powerful towboats ever built at Pittsburg, and which were originally designed for the coal trade. With 20 feet of water assured at South Pass, where the jetties are located, the river transportation of grain to ocean hulls bids fair to assume proportions that must jeopardize the overland carrying of grain between the upper Mississippi and the seaboard. Within the past few weeks the St. Louis and New Orleans Transportation Company and the Mississippi Valley Transportation Company have been in the market as purchasers for steamers and barges. The latter are of the variety known in Western waters as the "model" barge, in contradistinction to the coal or square barge. These craft are built to a model, and those recently contracted for are of the following dimensions: Length 225 feet, width 36 feet, hold 9 feet. The "cargo box" or receptacle for grain has a capacity for 60,000 bushels or about 1,500 tons. At present forty such barges are being built at different yards along the Ohio River, and the total number of barges that will soon find employment in the grain-carrying trade between the points named is placed by good authority at 120. A "tow" of such barges consists, under favorable circumstances, of five, a loaded barge drawing about eight feet. To make the round trip between St. Louis and New Orleans requires twenty days, and the freight on wheat averages 8 cents per bushel. The lack of return cargoes prevents this rate from being as great a "bonanza" as would appear from an income of $24,000 for a three weeks' job. Nevertheless it is a good thing for those engaged in this wholesale way of sending grain down the "Father of Waters." As a fair sample of the amount of merchandise carried by one "tow" of barges of less size than those described above, the following is appended: The steamer Jno. Gilmore's barges arrived at New Orleans within the past week, from St. Louis, with the following cargo: 680 bbls. and 315 half bbls. flour, 188 bbls. meal, 110 bbls. grits, 4,258 sks. corn, 200 sks. malt, 55 bbls. oil, 10 bbls. apples, 380 pckgs. lard, 786 bales hay, 39 pckgs. sundries, 101,499 bushels wheat, and 25,000 bushels corn in bulk.

STRENGTH OF YELLOW PINE.

From a paper read by Prof. R. H. Thurston before the American Association for the Advancement of Science, we find some very interesting facts relative to the strength of yellow pine and other timber. Prof. Thurston made experiments for determining the modulus of elasticity, using a very large number of specimens in his trials. He found that the deflection of timber bearing a load and supported at the extremities is very nearly proportional to the load, even far beyond the customary limits of strain, and that the modulus is very nearly constant for all moderate deflections. When higher loads (as one fourth or one eighth the maximum) were imposed for a considerable time, as ten or twenty minutes, the deflection gradually increased; on removal of the weight it steadily decreased, returning nearly to its original set. Heavy loads, long applied, produced fracture of pieces, the companions to which resisted considerably more when the load was increased steadily up to the moment of fracture. The maximum permanent load was apparently something less than one half and greater than one third the maximum load which could be sustained under ordinary test.

From the whole series of experiments Prof. Thurston drew the following conclusions: The elasticity of yellow pine timber, such as is usually used in construction, is very variable, the modulus varying from 1,000,000 to 3,000,000, the average being about 2,000,000 in small sections, and a little above 1,500,000 in large timber; the highest values are given as often by green as by seasoned timber; the density of the wood does not determine the modulus, the figure varying sometimes directly and sometimes inversely as the density, even where the amount of seasoning was alike; a high modulus usually accompanies high tenacity and great transverse strength; the resistance offered to transverse stresses is greatest where the lines of grain are vertical.

Prof. Thurston recommends the designing and constructing engineer to adopt a moderate value of the modulus in proportioning a work, and by careful inspection and test to secure the rejection of all material which is not of good quality.

A NOVEL IMPORTATION.

The *American Agriculturist* states that the large tea importing house of Messrs. Billinge & Wetmore, of this city, have recently received from their correspondent in Calcutta a very unusual and out-of-the-way consignment—this consisting of several tons of mahwa flowers, to be sold as cattle food. The idea of the "*effete* East" sending food to America seems strange enough. The mahwa tree and its edible flowers have already been fully described in the SCIENTIFIC AMERICAN and in the SUPPLEMENT, and we need only add that the flowers form such a valuable food product to the natives of India that in the expeditions made by the English against troublesome tribes, they have only to threaten to cut down the mahwa trees to bring the rebellious people to terms. A sample of the flowers as imported shows a soft sticky mass, having much the appearance of raisins of a poor quality, such as are packed in casks. When soaked in water the individual corollas swell out and assume a flattened, globular shape, about as large as an average cranberry, and are found to consist of a very fleshy cup, within which are a great number of anthers. At the instance of the *Agriculturist*, the consignees had an analysis made of this interesting product, and the report of the chemists shows that the flowers contain the remarkable amount of 63·40 per cent of sugar! This enormous percentage of sugar, without reference to other constituents, fully accounts for the value attached to the flowers in India as an article of food, and for use as a source of spirituous liquors. From a scientific point of view, the mahwa is a most interesting product; for it is rarely that we find the flower, the corolla of a plant, to serve any more than as a temporary purpose in protecting the reproductive organs within. For it to secrete more than half its weight of sugar, and thus become an article of economic value, and even of commerce, is most remarkable. The future of the mahwa as an article of trade in this country will, of course, depend upon its cost; and the commercial aspect of the article remains to be developed.

THE BRITISH ASSOCIATION MEETING.

The fiftieth annual meeting of the British Science Association began at Swansea, Wales, August 25. As usual the attendance embraced a large number of the best known promoters of science in the United Kingdom. The proceedings of the first session were purely of a business character, ending with a vote of thanks to the retiring President, Prof. G. J. Allman. In the evening, President-elect Andrew Crombie Ramsey, Director-General of the British Geological Survey, delivered his inaugural address, in which he considered at great length the recurrence of the same kinds of incidents throughout all geological time; in other words, the facts bearing upon the doctrine of uniformity of action and results, from the earliest geological epochs to the present day. In this address Prof. Ramsay considered the nature and evidences of metamorphism from the Laurentian epoch down to the pliocene period, arriving at the conclusion that at no period of geological history is there any sign of volcanoes having played a more important part than they do in the epoch in which we live. Mountain formation was next considered, the recurrences of the phenomena of mountain upheaval and development being discovered in every geological age. The recurrence of beds of various salts, chiefly rock salt, and the circumstances that produced them, were found to bear further evidence of the uniformity of physical conditions and causes throughout all time. Fresh water formations, deposited in lakes and estuaries, were traced from the Upper Silurian Blani beds of India down through geological time to the later Tertiary beds, showing the recurrence of similar conditions and geological operations in all ages. And equally striking testimony was borne by the successive glacial epochs, which have left their traces in abundance in various formations from almost the earliest paleozoic times down to the last post-pliocene period of ice. In summing up, Prof. Ramsay expressed the conviction that from the Laurentian epoch down to the present day all the physical events in the history of the earth have varied neither in kind nor in intensity from those of which we now have experience.

Reports of the subsequent proceedings of the association have not yet come to hand.

GREAT AND SUDDEN CHANGES OF TEMPERATURE.

Prof. Elias Loomis, in the current number of the *American Journal of Science and Arts*, offers an explanation of the great and sudden changes of temperature which frequently occur in some parts of the United States—a circumstance of which little account has thus far been taken. A very remarkable case of this kind occurred at Denver, Colorado, on January 15, 1875. In studying these sudden changes the first fact that attracts attention is that the air at Denver and its vicinity is very dry. Only one explanation of this dryness seems possible. The westerly winds from the Pacific Ocean have their moisture mostly condensed in passing over the Sierra Nevadas, so that between these mountains and the Rocky Mountains the air is extremely dry. By passing over the Rocky Mountains there is a further condensation of vapor, so that when the air descends on the eastern side of these mountains it is almost destitute of moisture. The vapor which comes up from the Gulf of Mexico is diffused over the Mississippi Valley and mingles with the dry air which comes from beyond the mountains, so that the dryness of the air rapidly diminishes as we advance eastward from the Rocky Mountains. Between 11 P.M., Jan. 14 (1875), and 7 A.M., Jan. 15, the thermometer at Denver rose 42°. The relative humidity fell from 71 to 21. The wind, which had previously blown from the northeast with a velocity of three miles an hour, at 9 P. M. veered suddenly to the southwest with a velocity of twelve miles per hour. The direction of the wind, the dryness of the air, and its high temperature, prove beyond a doubt that this air came from the West side of the Rocky Mountains, having been brought over the latter to Denver by a storm which had its center in San Francisco on Jan. 14, and which traveled about 1,400 miles in twenty-four hours. The vapor contained in this air would be mostly precipitated on the west side of the Rocky Mountains, so that it would descend on the east side deprived of its moisture, and with a temperature above that which prevailed in the Salt Lake basin, on account of the latent heat liberated in the condensation of the vapor. This warm and dry air supplanted the cold air which previously prevailed at Denver, and which still prevailed at neighboring stations east and north of Denver. After the center of low pressure had passed Denver, the northeast wind returned and brought back the cold air which had constantly prevailed at stations not very distant. In winter, during periods of extreme cold on the east side of the Rocky Mountains, when the temperature of Denver sometimes sinks more than 20° below zero, there prevails in the Salt Lake basin an average temperature of about 30°; and when by changes of atmospheric pressure this air is carried over the mountains it may reach Denver with a temperature of 50°, resulting from a precipitation of its vapor on the mountains. We then find a mass of air having a temperature of +50° in close proximity to a mass of air having a temperature of —20°, and by the movements of the atmosphere attending the progress of a great storm these different masses of air may be brought successively over the same station, causing a change of temperature of 50° in a single hour. Other cases of sudden change, which occur so frequently in the West, admit of similar explanation.

THE FAIR OF THE AMERICAN INSTITUTE.

The fair, considering the time which has elapsed since its opening on the 15th inst., is in good order, the majority of the exhibits being in position and in condition for examination; and while the character of the Exhibition is about the same as usual, it is on the whole very creditable, both to the managers and exhibitors, and it appears satisfactory to visitors.

We miss the display of electric lights, telephones, and other electrical apparatus, prominent features of former exhibitions; but it is possible they may appear later. The amateur department inaugurated this year is not as well patronized as we expected it would be, and most of the amateur exhibits are not creditable to our amateurs as a class. The photographic exhibits are evidently not all in place, but some that are to be seen are very fine. Mr. Rutherfurd shows several interesting photographs of solar spectra.

In the main building are a number of exhibits of which we may speak later.

In the machinery annex the main lines of shafting are driven by two fine horizontal engines, a Wheelock engine of 150 horse power, and a Whitehill engine of 50 horse power. An Otto gas engine of 7 horse power is connected with a line of shafting which drives several light wood working machines made by H. B. Smith. The New York Safety Steam Power Company exhibit several of their inverted vertical engines, and the Baxter engine is to be seen in different sizes. Colts' disk engine, made by the Colts Fire-Arms Manufacturing Company, is shown. It employs six pistons working in as many cylinders. The ends of the pistons act directly on a wabbling disk which carries the crank on the main shaft. In the line of woodworking machinery we find very little that is novel, although several of the prominent manufacturers are represented. Machinists' tools are almost entirely absent.

The Peerless Punch and Shear Company exhibit several foot and power presses, for descriptions of which we refer the reader to back numbers of this journal.

Among the novelties we find Allen's automatic grain weigher and register for weighing grain in the running stream. This machine takes care of itself, and weighs with perfect regularity, keeping tally of the amount of grain weighed with mathematical accuracy. A curious little machine for making cornucopias for putting up candies, groceries, seeds, etc., is exhibited by D. W. Seely, of Albany, N. Y. The paper goes through this machine literally "flying," and cornucopias are turned out at the rate of three hundred per minute.

Donald McKay.

Donald McKay, the once famous ship builder of East Boston, died at Hamilton, Mass., September 20. For many years his ships were in great demand. One of his first ships was the Washington Irving, for Enoch Train & Co.'s line of Liverpool packets. From that time until 1851 Mr. McKay built the Anglo-Saxon, 894 tons burden; New World, 1,404 tons; Moses, 700 tons; Anglo-American, 704 tons; A. Z., 700 tons; Jenny Lind, 533 tons; L. Z., 897 tons; Plymouth Rock, 960 tons; Helicon, 400 tons; Reindeer, 800 tons; Parliament, 998 tons; Moses Wheeler, 900 tons; Cornelius Grinnell, 1,118 tons; Sultana, 400 tons; Antarctic, 1,116 tons; Daniel Webster, 1,187 tons (lost at sea, 1853); Staghound, 1,534 tons. The discovery of gold in California created a demand for fast sailing vessels, and it was then that Mr. McKay's idea of clipper ships came into notice. Early in the season of 1851 he built the famous clipper ship Flying Cloud, 1,700 tons burden, which, under the command of Captain Cressey, made the extraordinary passage from Boston to San Francisco in 89 days. Mr. McKay, not satisfied with this, produced, in 1852, the Sovereign of the Seas, of 2,400 tons burden, the largest, longest, and sharpest merchant ship afloat at that time. She did not make so quick a passage to California as the Flying Cloud, yet, although she was dismasted, she beat the entire fleet of clippers that left at the same time by seven days, and on the homeward passage made the greatest run ever recorded.

Late in the fall of 1853 Mr. McKay launched the Great Republic, the largest merchant ship ever built, measuring 4,556 tons, and spreading 15,653 yards of canvas in a suit of sails. In the construction of this mammoth vessel, 1,500,000

feet of hard pine, 2,056 tons of white oak, and 336½ tons of iron were used. Fifty thousand days' work were done on her hull alone. She was towed to New York, but, while there, took fire and was burned at the wharf. Her upper works were rebuilt, and her size reduced about one-third. Her greatest speed has been 413 miles in twenty-four hours. Mr. McKay built many vessels in 1854 and 1855, but in the latter year the ship-building interests began to decline. His last ship was The Glory of the Sea.

AMERICAN INDUSTRIES.—No. 57.

THE MANUFACTURE OF PARLOR FURNITURE.

It is said that when Jenny Lind first visited America, and after she had been some time in New York City, she inquired where our "poor people" lived. She saw so many signs of thrift, comfort, and prosperity everywhere, so many evidences of culture in every class of people with whom she came in contact, the residences so commodious, and the people so well clad, in comparison with what she had seen in the Old World, that it appeared to her, even after she had been for some time in New York, that she had only become partially acquainted with real life here. In the prosecution of no other one line of business, perhaps, is this distinction so clearly brought out as in the industry which we this week make the subject of our first page illustrations. In no other country in the world has such an industry heretofore been possible, carried on in the manner and according to the scale on which it is here conducted, for, although it is true that equally beautiful and far more elaborate specimens of household furniture and decoration are to be met with in the mansions and palaces of the older countries of the world, such work there is almost always made to order, and obtainable only by the few, at a cost far exceeding the price of quite as serviceable and very similar goods here.

There has been a rapid development of this branch of business within the past twenty years, and with its growth has come a natural division according to which the different specialties are made exclusively by particular manufacturers. The manufacture of dining-room and chamber furniture each constitutes separate lines of business, while parlor furniture is a specialty of itself, and the leading details of this department of the trade are shown by our artist, as the industry is conducted by Messrs. M. & H. Schrenkeisen, of New York City.

The first operation in the manufacture is represented by the view at top of first page, where the log, as it comes to the factory, is taken by a large band saw and cut into the thicknesses and lengths required. This saw runs on a wheel about five feet in diameter. An adjoining view shows a smaller band saw, used to cut up plank and boards and further divide the lumber into the different sizes to fit it for the several pieces to be made. There are seven of these band saws and nine jig or scroll saws in constant operation. The wood having been cut to the required size, the first detail of the manufacture consists in the marking of the patterns thereon. This was formerly done with a pencil, but now stencil patterns are made in zinc, by which the pattern is so plainly shown on the wood that there is much less liability to error in cutting than was formerly the case.

Previous to the work on the jig saws, nearly all the pieces have to go to the boring machine, where holes of different sizes are put through such parts of the pattern as required to enable the workman to pass through the end of the saw in cutting out the design. These holes are usually bored in places where the curves are so small that it would be difficult to work them out with the saw, although some of the jig saws are less than an eighth of an inch wide. The workmen in this department, however, from long practice, are able to follow the intricate patterns with such firmness and facility that the most complicated designs are worked out with great rapidity, and apparently without the least pause or hesitation.

The friezer, or machine carver, shown in one of the views at the top of the page, takes up but little room, but the variety of work it will do is almost unlimited. There are several modifications of this machine, for different classes of work, but the essential principle in them is the revolution, on a small axis, of different shaped knives, according to the design of the work, the wood being pressed against the knives in the line of guides and gauges adjusted to the particular pattern. In this way the machine may be adjusted to do almost any kind of carving desired, but it is found more economical in practice to do a large proportion of the carving by hand, rather than fit up the knives and patterns for the machine for all the new and elaborate designs in carving which are always being introduced.

The variety moulder, shown in one of the illustrations, represents only one of several machines in operation for this department of the work, but it is one which will cut almost everything known to the trade in the way of mouldings. The planing and turning machines, which are also the subjects of separate views, are of several sizes, and of patterns entirely familiar to all wood-workers, but the "jointer" is a machine less commonly known. It is to put a smooth edge or corner on pieces to be joined together, and it makes the edges and angles, either flat or any desired bevel, so smooth and even that when two pieces of wood of the same grain are placed together it is difficult to see where they join. The sand-papering machine shown at the bottom simply represents arms covered with sand paper, which are made to rotate very rapidly while the workman passes the rough surfaces over them to smooth off the unevenness made by the saw or planer.

The carving by hand, of which a view is given in one of our illustrations, forms a very important part of the work done at this establishment, at which from thirty to forty expert hands are kept regularly employed. This work is all done by the piece, from original designs gotten up by the house, the firm being constantly engaged in contriving something new which is likely to please the artistic taste of the community. In this way they will get up a suit of parlor furniture, subject it to criticism, make possibly considerable alterations in it, decide on the different ways in which it will be upholstered, and then have from one to two hundred sets made of this particular style. No one outside of their own immediate business is allowed to know what their new designs are until these sets of furniture are finished and ready to put on the market. In short the firm take the log as it comes from the woods, and do every part of the work necessary to make therefrom the completed furniture as it appears in the parlor, and all from new and original designs of their own.

One of the most important details of the work, without the most sedulous care in regard to which it would be impossible to make durable work, is the proper seasoning of the lumber. Only the best seasoned wood is used to start with, but it is almost impossible to thoroughly season a thick plank all through. After the work is cut out in the rough, therefore, the pieces all go to the drying room, a large apartment with slatted floors, under which run steam pipes, by which the temperature can be kept up to and above 100° Fahrenheit constantly. In this way the moisture is thoroughly evaporated, and all after danger of cracking from exposure to unusual warmth is avoided, as the finely finished work, in which the pores of the wood are all closed, and its surface has a glass-like polish, will not allow of its afterward absorbing moisture from the air. The cracking which sometimes happens in very old furniture does not arise from this latter cause so much as from the improper gluing of panels, etc., a detail which here receives careful attention.

The upholstering and finishing of the work is all done at the warerooms, on Elizabeth street, near Canal street, where the firm occupy a six story building, L-shaped, but covering a space equal to 50 by 150 feet. This building, as also the factory on Monroe street, 100 by 100 feet, and six stories high, are shown in the view in the center of the page. A 100-horse power engine furnishes the power required at the factory, and this is run almost entirely by the shavings and turnings made in the work.

Most of the goods now made are of cherry, "ebonized," as it is called, and black walnut. The ebonizing is done by dipping the furniture in an acid coloring bath, which turns it black and eats its way into the wood so as to give more than a surface coloring, and a scratch or light cut shows black underneath. In this style of furniture a large portion is finished with lines, bands, and beading in gold leaf, though some of it is also made in plain black, either brightly polished or what is called a dull finish. In the upholstering department the final work of finishing is never put on the goods until just before shipment, as finished furniture of the finest quality requires great care. In sofas, easy chairs, rockers, etc., steel springs, hair, and moss, are used, as may be required for different kinds of goods, but only the best qualities of any kind of stock are employed, and, although a fine finish is always obtained, the work is throughout of the most solid and substantial character.

The firm are the owners of several patents connected with the furniture manufacture, among the most successful of which have been their patents on spring rockers, for which they had a great run for several years after they were introduced, and which still form a leading article in the trade. They have also obtained a number of patents on band embroidery trimmings and coverings. The most of the goods used for coverings are imported, orders being given on samples sent here by European manufacturers, with the agreement that the firm shall have the exclusive control of these styles for a definite period, or until they shall have had time to put their goods on the market. The variety of these coverings is very extensive, embracing almost everything in the way of raw and finished silk, figured stuffs in satin, tapestries, reps, serge, damask, plush, etc., the patterns of only a small portion of which can be found in the large and handsome illustrated catalogue issued by the firm. In order, however, to keep their customers and agents fully informed in regard to the new styles they are constantly getting out, they have a photograph establishment fitted up in one portion of their warerooms, where they make prints of each new set of furniture when it is ready to put upon the market, and from which they receive orders from agents and dealers.

The firm have already done some business in the way of exporting furniture, but the foreign demand for ready-made upholstered parlor furniture, which is the particular specialty of this house, is relatively far less than is the call for these goods in our own country, where almost every well-to-do mechanic has his parlor, or "best room," furnished in a way which is almost unknown among the same classes in other parts of the world.

DECISIONS RELATING TO PATENTS.

By the Acting Secretary of the Interior.

EX PARTE GREAVES.—CONDENSING CYLINDER FOR CARDING MACHINES.

Bell, Acting Secretary.

1. The Commissioner of Patents may issue a patent for one or more of the divisions of a reissue application, and subsequently issue a patent to the applicant for the remaining divisions, if it be held that otherwise he is entitled to them.

2. Until an application for reissue is ended in all its divisions the vitality of the original patent continues so far as required to support that portion of the application which remains undecided.

By the Commissioner of Patents.

EX PARTE LEE.—COUPON RAILWAY TICKET.—APPEAL FROM THE EXAMINERS-IN-CHIEF.

Marble, Commissioner:

1. The patentable features of a railway or other ticket, like those of any other substantive thing, must depend upon peculiarities of mechanical construction.

2. The printed matter upon a ticket is nothing more than an arbitrary direction as to how such ticket is to be used, and can have no bearing upon the patentability of the ticket itself.

3. A railway ticket anticipated by an internal revenue stamp where the system and the manner in which it is carried out is substantially the same.

4. Duplication of checks or coupons as a matter of expediency, obviously suggested by the necessity of the case, does not require invention.

THE FRANKLIN SEARCH EXPEDITION.

The members of the Franklin search party under the command of Lieutenant Frederick Schwatka, U. S. A., were picked up, August 1, by a New Bedford bark, at Depot Island, Hudson's Bay, where they had been since March 4. The party had been for two years exploring the regions north and northwest of Hudson's Bay in search of relics of Sir John Franklin's expedition. Reports of the first year's work were received and published about a year ago. Having come to the conclusion that the records of the Franklin expedition might be preserved in cairns in King William's Land, Lieutenant Schwatka set out on the first of April, 1879, to look for them. During the succeeding eleven months he accomplished the longest sledge journey ever made in an unexplored Arctic country, traveling in all 3,251 statute miles. It was the first sledge journey ever made that covered an entire Arctic winter; and the temperatures experienced exceeded in frigidity anything ever before encountered by white men in the field.

On January 3, 1880, the thermometer sank to 71 degrees below zero, Fahrenheit, or 103 degrees below freezing point, and during the entire day it did not rise above —69 degrees. During sixteen days the average temperature was 100 degrees below the freezing point, and during twenty-seven days it was below —60 degrees. All this time the party traveled, in fact they never halted a single day on account of the cold.

During the summer and fall of 1879 they made a complete search of King William's Land and the adjacent mainland, traveling over the route pursued by the crews of the Erebus and Terror upon their retreat toward Back's River, and while so engaged the party buried the bones of all those unfortunates remaining above ground and erected monuments to the memory of the fallen heroes. Their research established the mournful fact that the records of Franklin's expedition are lost beyond recovery.

A large quantity of relics were gathered by the party to illustrate the last chapter of the history of Sir John Franklin's expedition. From each spot where the graves were found a few tokens were selected that may serve to identify those who perished there. A piece of each of the boats which had been found and destroyed by the natives was brought away, together with interesting though mournful relics in the shape of the prow of one of their boats, the sledge upon which it was transported, and part of the drag rope upon which these poor fellows tugged until they fell down and died in their tracks. In addition to these the party secured a board which may serve to identify the ship which completed the northwest passage.

They also brought the remains of Lieutenant John Irving, third officer of the Terror, which were identified by a prize medal found in his opened grave. The party endured many hardships and were threatened with starvation after their return to Depot Island, where they failed to find the supplies which were to have been left there for them by the schooner Eothen. The party suffered no serious sickness while in the field.

A Remarkable Group of Solar Spots.

To the Editor of the Scientific American:

One of the very finest groups of sun spots it has ever been my pleasure to witness was observed by me through the five-inch Newtonian telescope yesterday morning, September 12, 1880. It was situated then about midway from the center of the sun's disk and the western limb south of the equator. Its length was enormous, occupying a space equal to one-quarter of the sun's diameter, and therefore over 200,000 miles in length. I present herewith a sketch made of the group at the eyepiece of the telescope, and which conveys but a faint idea of its grandeur. At A and B were quite large spots, surrounded by a very delicate penumbra, while at C was a most beautiful cluster of small spots. The whole group was remarkable for its brilliance and distinctness. In addition to this large group there was a fair-sized single spot near the center of the disk, with a faint penumbra and dark markings in its vicinity; also a faint double spot below this one.

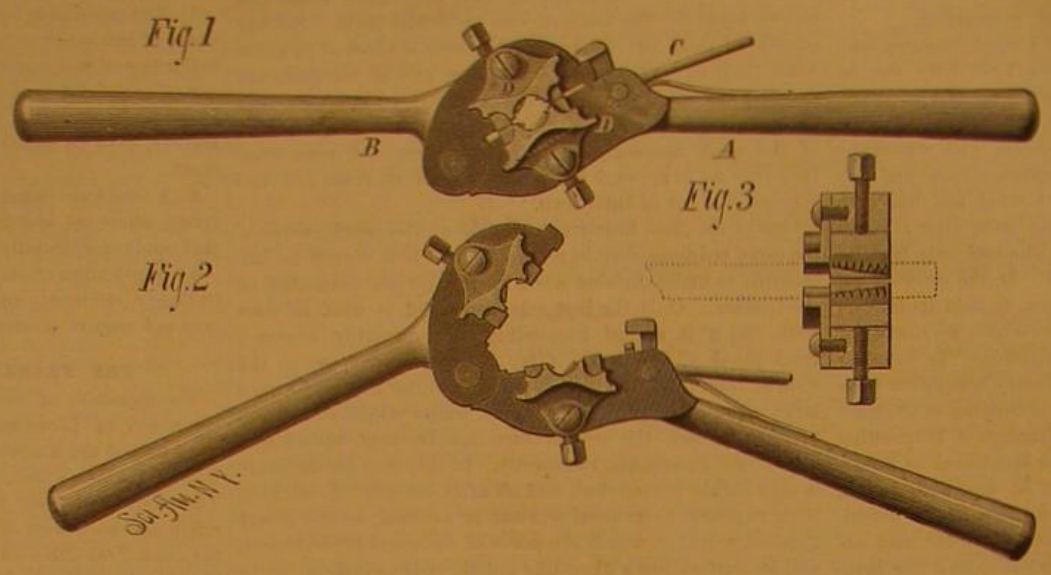
WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y.,
September 14, 1880.

IMPROVED DIE STOCK.

The engraving shows an improved stock for holding screw-cutting dies which affords all the advantages of a solid die as well as the desirable features of a separable die. It saves about half the time and labor usually required in screw cutting, as the die can be removed from the work after cutting the screw without running it back.

The two parts, A B, of the stock are hinged together and join each other diagonally. A spring catch, C, on one half engages a projection on the other half when the stock is in use. The die is of the usual pattern, except that it is divided instead of being solid. It is retained in mortises in the stock, and to each half of the stock is pivoted a segmental guide piece, having in its edge semicircular recesses, the opposing recesses forming a circular sleeve or guide which fits the rod or pipe to be threaded. The recesses vary in size to adapt the guides to different sizes of pipe or rod. While cutting a thread the stock and die are used in the ordinary way, but when the thread is completed the part, A, is released from the part, B, by pressing on the long arm of the catch, C, when the two parts are separated as shown in Fig. 2, and removed from the work. Fig. 3, which is a transverse section of the stock and die, shows the relative position of the stock, die, and guide.



WALKER & WILLIAMS' DIE STOCK.

With this tool threads can be made quickly and easily, and also more perfectly than with the solid die, as all the difficulties arising from the clogging of the die by chips, and tearing the threads in efforts to remove the clogged die in the usual way, are avoided.

This invention is now on exhibition at the American Institute Fair. The patentees, Messrs. Walker & Williams, of Sing Sing, N. Y., should be addressed for further information.

A NOVEL TENT.

A convenient tent, adapted to the wants of excursionists, tourists, sportsmen, etc., is shown in the annexed engraving. It is light, portable, and easily set up and taken down, and affords a convenient and desirable shelter or shade.

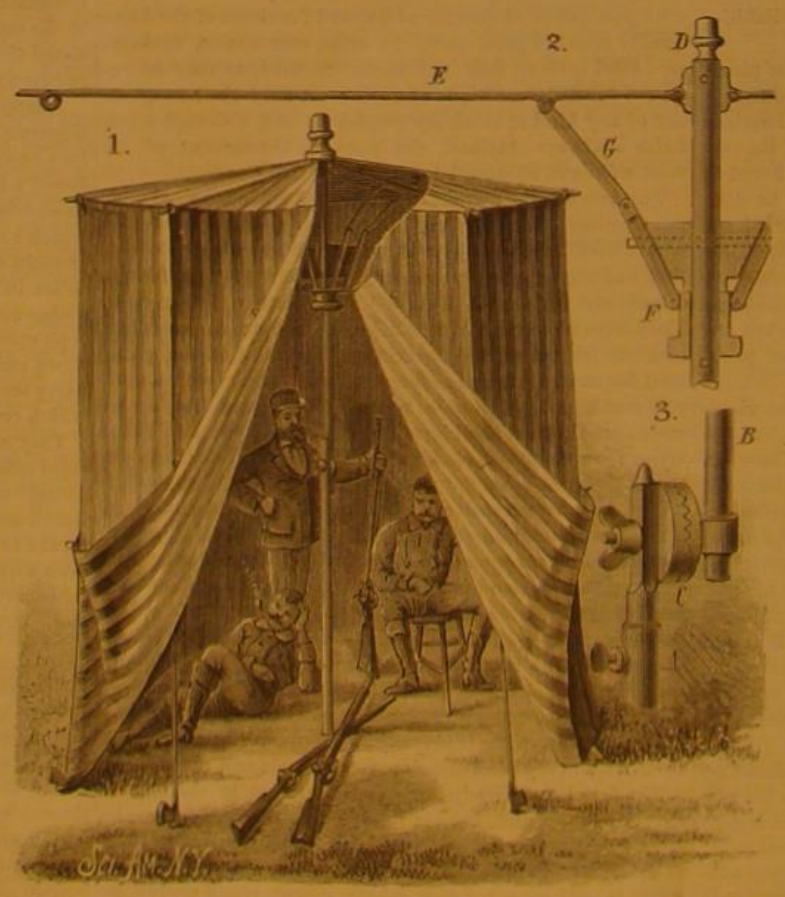
The construction of the frame is very simple, being somewhat similar to an umbrella frame. The tent is shown complete in Fig. 1, and Figs. 2 and 3 are detail views of various parts of the tent frame.

The tubular standard, A, which receives the pole, B, has a pointed end to facilitate driving it into the ground. The pole, B, has an adjustable joint, C, by means of which the frame may be inclined at any desired angle, and securely fastened by turning the wing nut. The upper end of the pole is provided with a head block, D, to which are pivoted the ribs or arms, E, which support the canvas forming the top of the tent. A slider, F, is connected with the ribs by braces, G, which are jointed in the middle to facilitate folding and packing the frame. The ends of the ribs, E, have an eye formed in them for receiving a cord to assist in supporting and stretching the tent covering.

When it is desired to use the tent in a hall or upon a platform, the lower end of the standard, A, is inserted in a cross-shaped foot formed of two pieces of plank fastened together at right angles to each other.

This tent forms a convenient shade and shelter for working animals while at rest, and will often be found convenient for covering goods of various sorts when piled out of doors.

This invention was recently patented by Mr. A. E. Shemeley, of Jamesburg, N. J., who should be addressed for further information.



SHEMELEY'S IMPROVED TENT.

Talk Over What you Read.

Nearly forty years' experience as a teacher, says a writer in the *Christian Union*, has shown me how little I truly know of a subject until I begin to explain it or teach it. Let any young person try the experiment of giving in conversation, briefly and connectedly, and in the simplest language, the chief points of any book or article he has read, and he will at once see what I mean. The gaps that are likely to appear in the knowledge that he felt was his own will no doubt be very surprising. I know of no training superior to this in utilizing one's reading, in strengthening the memory, and in forming habits of clear, connected statement. It will doubtless teach other things than those I have mentioned, which the persons who honestly make the experiment will find out for themselves. Children who read can be encouraged to give, in a familiar way, the interesting parts of the books they have read, with great advantage to all concerned. More than one youth I know has laid the foundation of intellectual tastes in a New England family, where hearty encouragement was given to children and adults in their attempts to sketch the lectures they had heard the evening previous. The same thing was done with books.

Centrifugal Force in Millstones.

An accident, notable by reason of its rare occurrence, took place at the City Flour Mills, Pittsburg, on the morning of the 7th of September. It was the bursting by centrifugal force of a French burr millstone, resulting in the instant death of Mr. Manning, one of the oldest millers in the country. The stone was made in Buffalo, N. Y., and had been in use only two years, was banded and put together in apparently first-class style. No defect was evident upon investigation. At the time of the accident the supply of grain had become exhausted, and though the only person competent to throw light upon the circumstances was killed, it is believed that this failure in the feed so increased the speed and heat of the burr as to produce the fatality described. The usual rate of speed for this stone was 200 revolutions per minute.

Laundry Machines.

The *National Laundry Journal*, which ought to know what improvements are needed in laundry establishments, thinks, while perfection in washing machines has been nearly reached, there is a field for improvement in other branches of the business. The washers, it says, are very near perfect, but there is much other apparatus used in laundry *operandi* that is susceptible of improvement, and if our inventive geniuses would give us something way ahead of anything at present in existence, we would not only give them a big obituary notice when they are called to climb the golden stair to Paradise, but we would almost be willing to guarantee them a fortune in the sale of their improvements.

The Pharmaceutical Association.

The twenty-eighth annual meeting of the American Pharmaceutical Association was held in Saratoga, September 14 to 18. A fine display of drugs and chemicals was an interesting feature of the meeting, over fifty leading druggists and manufacturing chemists being represented.

ENGINEERING INVENTIONS.

A traction engine, so constructed that the tracks may be carried forward by the drive wheels and kept securely in place, has been patented by Mr. David J Havenstrite, of Newark, N. J.

Mr. Charles R. Simey, of Sunderland, England, has patented an improved steering gear, which consists of improved self-acting apparatus constructed and arranged to shut off the steam when, or just before, the helm attains the desired position. The position to be given to the helm is indicated by a pointer moved by the steersman, the actual movement of the helm being indicated by another pointer moved in turn by the machine itself, and the steam being automatically shut off when these two pointers coincide.

Mr. William Hadden, of Brooklyn, N. Y., has invented a novel electric signaling instrument, which is so constructed that the circuit closer will be stopped automatically as soon as the signal is given, and held in place until the signal is to be repeated. The invention consists in a block having a ring groove, in the bottom of which there are contact points connected with the circuit wire. A spring crank arm, connected with another circuit wire, is capable of touching all of the contact points in making one revolution. A stop arrests the arm at the end of the revolution, and a spring latch drops into a notch in the block and prevents retrograde motion. When a second signal is to be sent the crank arm is released from its stop by pressing it inward, when it may be turned until it again strikes the stop.

Bathing.

It is important to recognize that the only virtues of water as used by the bather are two—namely, its value as a cleansing agent, and as a surface stimulant. In this last capacity it simply acts as a medium affecting the temperature of the part to which it is applied, or which is immersed in it. Right views of fact in reference to this matter are important, because there can be no question that some persons overrate the uses of cold water, and run considerable risks in their pursuit of them. Every beneficial action that can be exerted by a bath is secured by simply dipping in the sea, or a very moderate affusion of cold water! Except in cases of high fever, when it is desired to reduce the heat of the body by prolonged contact with cold, a bath of any considerable duration is likely to be injurious. Then, again, it is necessary to recognize the risk of suddenly driving the blood from the surface in upon the organs. The "plunge," or "dip," or "shower," or "douche," is intended to produce a momentary depression of the temperature of the surface in the hope of occasioning a reaction which shall bring the blood back to the surface with increased vigor, and almost instantly. If this return does *not* take place; if, in a word, redness of the skin is not a very rapid consequence of the immersion, it is impossible that the bath can have been useful, and in nine cases out of ten when the surface is left white or cold it does harm. The measure of value is the redness which ensues promptly after the bath, and this reaction should be produced without the need of much friction, or the bath is not worth taking. The rubbing employed to recover the circulation lost by the bath would probably have done more good without it! Another effect of the bath when it acts properly is to stimulate the nervous system, through the vast series of its terminal fibers which are distributed in the skin. In this way also the action must be very rapid, or it is not efficacious. Unless the vigor of energy is quickly called out, the agent is useless; and if it produces either drowsiness or depression it acts mischievously, and lowers the power it is intended to stimulate and augment.

Bathers should bear these facts in mind, and be warned by them not to trifle with an agency which, if it is not of value, is worse than useless, and can scarcely fail to do harm.—*Lancet.*

WATERPROOFING CLOTH.—Cloth coated with linseed oil to which a little wax and litharge have been added, will be waterproof.

The Ferocious Frog.

The London *Telegraph* relates the following story of the curious propensity of the frog, alleged to have been discovered during the draining of some huge carp ponds upon Count Schaafgotsche's estate of Warmbrunn. Upon transferring the fish from these preserves to baskets, for the purpose of conveying them to tanks wherein they might disport themselves while their old familiar quarters were being cleansed, it was observed that frogs were clinging to backs of many of the larger carp. Most of the fish thus beridden were blind, the frogs' fore feet being found firmly fixed in the eye sockets of their victims.

Interrogated respecting this strange phenomenon, the chief pond keeper told our contemporary's informant that, according to his experience, extending over several years, frogs were the deadliest enemies with which carp had to contend, and caused an annual mortality among the fish under his care of from 3 to 4 per cent of their total number. The frog's object in bestriding the carp, he said, was to feed upon the slimy matter that so frequently forms a sort of spongy crust on the heads and backs of the older fish; and, once settled in their favorite seat, they speedily succeeded in gouging their finny steeds, which, when blinded, being unable to look out for their food, soon perished of hunger. How tightly these voracious batrachians hold on to their living pastures was exemplified by the pond master, who picked up a carp weighing two pounds and a half, and held it suspended in the air by one of the hind legs of a frog perched upon its back in the manner above described. Carps thus frog ridden to death begin to turn yellow on the third day after the parasitical croaker has taken his seat, rapidly waste away, and generally die within a fortnight from the commencement of their martyrdom. In clear water it is pretended that they can espy their nimble foe as he prepares to spring upon them, and by a timely wriggle often escape his attack; but in dim and slimy old ponds, like those of Count Schaafgotsche, they too frequently fall a victim to his saltatory skill and merciless appetite.

Alaska Seal Skins.

During one week recently 950 casks of Alaska seal skins arrived here by the Pennsylvania Railroad. They, with 450 casks more to come, were going to London to be dressed for market. The consignment contained about 92,500 skins, and was valued at nearly $1,000,000. The cost of freight to this point was almost $600 for a carload of forty casks. The skins are tied in oblong bundles and pickled in salt. It requires eight skins to make a full sack, and they have to be dressed and dyed by London furriers and then reshipped to this country.

THE CORAL SIGNET OF THE KING OF ITALY.

Among the beautiful pieces of coral exhibited by Messrs. Mazza, Guiseppi e Figli, from Torre del Greco, near Naples, at the Berlin International Fisheries Exhibition, was a branch of coral weighing eleven pounds, valued at $3,000, and another branch, in three colors—white, pink, and red—and which has been in the hands of the family for two hundred years. Further, a necklace valued at $6,000, and, finally, the beautiful coral signet represented in the annexed engraving, for which we are indebted to the *Leipziger Illustrirte Zeitung*. The signet is cut from a bright-red piece of coral, and is a representation of the royal family of Italy. On the top we find the portrait of the late King Victor Emmanuel, below him, at the right, the present Queen Margaruite, at the left the present King Humbert, and below the latter two their son, the Crown Prince, surrounded by flowers and emblems. The firm of Mazza presented this signet to the King, who accepted it, but desired to have it exhibited at the Berlin Exhibition before taking permanent possession of it.

THE CORAL SIGNET OF THE KING OF ITALY.

THE MOLLUSKS AT THE BERLIN FISHERY EXHIBITION.

We have given illustrations of various parts of the Berlin Fishery Exhibition, and of the animals exhibited there, and now we add another cut representing the "mollusca."

Fig. 1 represents the *Rhizostoma aldrovandii*, whose transparent disk, ornamented with blue, violet and scarlet stripes, attains a diameter of two feet. A series of transparent gelatinous members are suspended from the under side of the disk, and carry the stomach of the animal, which terminates in eight wonderfully fine tentacles. By contracting the disk or bell the animal can propel itself and can change the direction of its movements. The specimen we have represented is the first of its kind that was ever brought to Berlin alive, and has given opportunity to observe very many of its peculiarities. It constantly remains above the opening through which the clear water containing a surplus of oxygen is admitted into the tank.

In Fig. 2 the most beautiful representative of the class of medusæ, known as the *Turris digitalis*, is shown, and resembles a balloon woven of the finest and most transparent of materials. The dark spots in the interior represent the organs of generation, which are of a strawberry-red color. The tentacles are of a glaring white, and have an ordinary length of about one to one and a half inches, but can be lengthened to eight or nine inches in an instant.

The *Cydippe brevicostata* (Fig. 3) has not been so profusely provided with ornamental appendages as the other members of the medusæ family. The development of the medusæ is highly interesting and instructive, on account of the changes which take place in its generation. The egg passes from the female organ in an infusorial form, and swims about in the ocean a short time by means of the hairs that cover it, and finally attaches itself to some sea plant, rock, etc. Here it develops itself into a polypus provided with tentacles. In a short time contractions take place, so that the animal represents a series of flat glass cups or saucers placed above each other, and finally each of these cups is separated from the main body and is an independent animal. Before the discoveries of Ehrenberg the above polypus had been treated as being a distinct kind of animal and belonging to a certain class.

A most peculiar inhabitant of the ocean is the *Tethys fimbria*. It has a series of knotted rudimentary branches, containing the gills, on the back. The head consists of a large cape with two side wings, called the sails, and containing the eyes; and the mouth consists of a funnel-shaped opening under the cape. The parts shown on the back of the animal drop off as soon as they are touched, and have vitality for a short time.

We are forced to place the wool-crab, Fig. 5 (*Dromia*

THE MOLLUSKS AT THE BERLIN FISHERY EXHIBITION.

vulgaris), among all these beauties, but the peculiarities and oddities of his manner of living will compensate the observer for the lack of beauty. The reddish-brown mass on his back is a cork-sponge (*Suberites domuncula*), which keeps company with him. If the sponge is detached from the crab, and both are placed in a tank, the spectator will see a most humorous performance, for the crab will endeavor to procure his mantle and will make the most frantic attempts to get it; in fact he will behave about in the same manner that any person would that has been deprived of a very much needed garment. If he finally gets his covering again he places it upon his back, shifts it, tries it, and after many attempts is at last satisfied. The crab disguises himself by means of the sponge, which grows so rapidly that it is ofttimes difficult for the crab to reserve for himself the freedom of movement for his limbs and continually munching jaws. The crab generally locates himself in the neighborhood of other sponges and there waits for his prey, either attacking them in open fierce combat or in his sly and stealthy way, of which it is a great favorite.

The nests of the weaver bird or the stickleback fish are real masterpieces of animal ingenuity, and are deserving of the praise they call forth; but if we remember that the intelligence of vertebrates is far superior to that of the mollusca, we cannot do otherwise than admire the nest building file-shell (*Lima hians*), Fig. 6. The shell is absolutely white, and fringed by numerous orange-colored tentacles, which serve to furnish the food and the breathing water, as also to build the nest.

The peculiar nest, which is built of small pieces of shells and stones, connected by very fine threads that the animal spins, resembles a fortress, from the main entrance of which the tentacles of the shell project in a defiant manner. The *Lima* swims very well, and drags its tentacles along like the tail of a comet.

The finger date shell (*Lithodomus dactylus*), shown in Fig. 7, bores through the hardest rocks slowly but surely. Schleiden relates the following in regard to it: The temple ruins of Serapis are situated near Puzzuoli (in the Bay of Naples), and three of the columns still stand erect. The columns are of the most beautiful Cipollini marble, and the first seventeen feet are perfectly intact and smooth, but the next seventeen feet have been perforated by numerous date shells, and in some of the apertures the shells are still to be found. The remaining forty-five feet of the columns have been very much affected by the atmosphere. All this is very easily explained, if we assume that the ground upon which the temple stands settled so that the columns were immersed in the ocean to the height of thirty-four feet, and were then perforated by the date shells. Later the land rose again, and the columns were once more upon dry land. Odd documents give proof that the temple formerly stood in the ocean, but that the land began to rise in the fifteenth century, for one of the old deeds of those times conveys to the priests of Puzzuoli "all the new land that is rising out of the water." The ground sank about fifty-two feet, rose again, and, according to all appearances, is now sinking. All these movements were so slow and gradual that not a stone has been displaced, and the columns stand as straight as they ever did. The question arises, By what means does the date shell accomplish its gigantic task? Some assumed that it secreted a strong and powerful dissolving liquid, the composition of which we do not know, but closer examination has revealed the fact that the boring is accomplished by means of fine silica needles on the feet of the animal, so that mechanical labor is required.

Fig. 8 represents a sponge—the antler sponge (*Raspailia ciminalis*), in view of its peculiar shape.

Fig. 9 represents the well known sea cucumber, or *Cucumaria planci*.

A New Orang-Outang in London.

The somewhat formidable animal whose arrival at Mr. Jamrach's establishment was noticed in a recent impression of the London *Daily News*, from which paper we extract, has been safely housed at the Royal Aquarium, Westminster. In order to secure his comfort, and it may be added that of the public also, a strong cage has been fitted up, the bars of which are stout enough to allay any apprehensions as to the possibility of its restless occupant finding his way out. Writing on the subject of the orang-outang, Mr. Frank Buckland says that, "so far as can be judged he is an adult, or nearly an adult. He has been brought from Malacca in a box three feet high, and as he sits in the box the top of his head almost touches the top of the box." Stretched to his full height he measures about four feet, and seizes the bars at the top of his cage with the greatest ease, swinging to and fro with all the agility of his race. Some idea of his great strength may be gathered from the nervous energy with which he grasps the bar with his fingers, which are about five inches long, and from the muscular development of his arms and shoulders. He peels an orange with great dexterity, and sucks it with evident relish. He is fond of retirement, and when an opportunity offers will envelope himself from head to foot in his blanket, any attempt to remove which arouses a display of passion which would suggest a speedy retreat on the part of the offending person. His anger is expressed in a peculiar manner. He purses up his lips as though about to whistle a tune, and dashes about his cage with restless energy, stopping every now and then to peer through the bars in search of his enemy.

When in good humor his natural ugliness and the fierceness of his eyes are much softened by the intellectual formation of his forehead, which may be said to be beautiful by comparison with the other portions of his frame. This is a point in which naturalists will no doubt be interested. Although somewhat shy, he does not absolutely shun the public gaze, but generally looks straight before him over the heads of the crowd, as though searching for some object familiar to him. Any unusual sound, such as the beating of a drum, attracts his attention at once, and causes him to turn his head round sharply in a listening attitude.

Concluding his remarks upon this singular animal, Dr. Buckland states that "the hair about his head is so arranged that he appears to wear whiskers. He has, moreover, a red dish beard, and under his beard is a very remarkable pouch, the use of which has not as yet been clearly ascertained. As, however, it is capable of dilatation with air, it is, in all probability, directly connected with the organs of voice. It is a wonder to me how ever the natives managed to catch him, whether as an infant or full growth."

A NEW ACID PUMP.

The use of acids in the arts and manufactures is of great importance, and there is scarcely a laboratory or factory which does not use more or less acid, the quantity varying from a single carboy a month in the smaller establishments

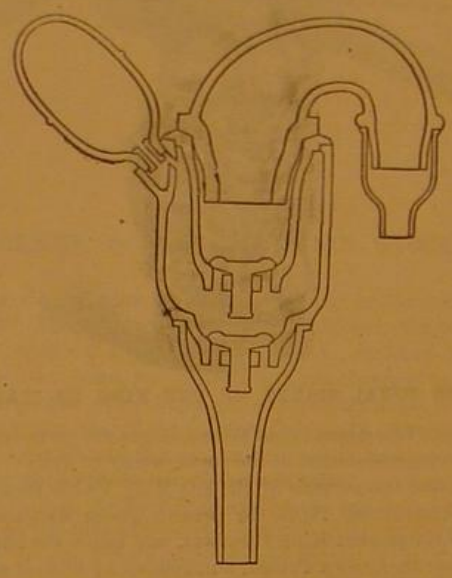


Fig. 1.—VERTICAL SECTION OF ACID PUMP.

to more than one hundred carboys a day in the larger works. The carboy, as is well known, consists of a large glass bottle holding from ten to twelve gallons, packed in hay, in a box with its neck protruding from three to six inches. A carboy of sulphuric acid weighs from 170 to 200 pounds, and is a heavy and cumbersome article to handle; and the problem of getting the acid out of this inconvenient holder without danger to life, clothing, and floors, has been the subject of much study and experiment. Various expedients have been resorted to for removing acid from these unwieldy packages, but they have been regarded as impracticable and unsatisfactory.

The late Francis Nichols, of New London, Conn., devoted his time for about eight years to study and experiment in this direction, and invented a pump which would pump the acid independent of the carboy without injury either to the pump or acid. His last inventions and improvements have recently been patented in this country and in Europe.

The principle on which the pump is constructed may be seen in Fig. 1. The body or working part of the pump con-

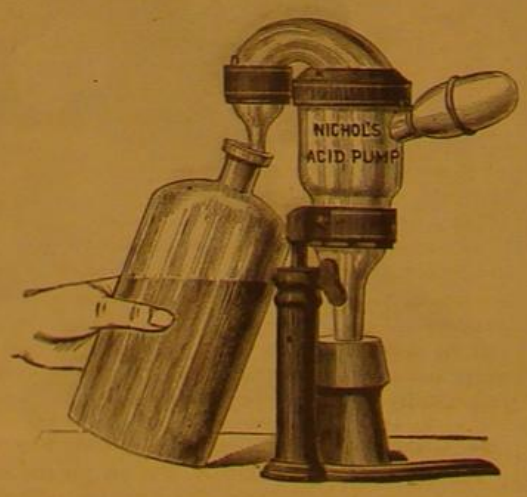


Fig. 2.—NICHOLS' ACID PUMP.

sists of three glasses and a rubber bulb. The glasses are very carefully ground together and secured at the joints by screw couplings, making them perfectly air-tight. The two valves are fitted to their places and carefully ground by machinery constructed especially for the purpose. In use: the rubber bulb is compressed by the hand, which drives the air into the chamber between the glasses, C and B. The lower valve remains tight, and the air escapes through the valve near B. The hand, now removed from the bulb, allows it to expand, and as a vacuum is created in the chamber the upper valve closes and the acid rises through the section tube into the chamber to fill the vacuum. Another compression of the bulb drives the acid up through the upper valve, and the chamber is again filled with acid; as this operation is repeated the liquid flows from the nozzle of the pump. The relative capacity of the chamber and bulb is so nicely adjusted that the acid never rises high enough in this chamber to enter the bulb. It will be noticed that an air chamber is formed at every joint by a downward projection of the top piece; this prevents the acid from ever reaching any joint so long as the pump stands erect. A discharge tube attached to the nozzle of the pump extends to a point just below the bottom of the carboy, so that continuous pumping for a short time will give a siphonic action which can be instantly arrested at any time by the removal of the bulb from its nipple. A metallic bulb may be substituted for the rubber one, giving greater power. By means of a metallic bulb a large tube may be used on the siphon, which will be capable of emptying a carboy of sulphuric acid in less than three minutes.

By the pump shown in Fig. 2, without the siphon, the quantity delivered can be nicely measured. Its action is rapid and perfect. The glasses are entirely enveloped in a light cast iron covering handsomely ornamented, and the apparatus is light, durable, and perfect in its action. Any quantity of acid can be drawn without the least danger to clothing, person, or floors, and the person using the pump, who may be entirely inexperienced in such matters.

These pumps have been examined and approved by the U. S. Mint, Assay Office, and Torpedo Station; the fire departments of New York, Boston, Lynn, Cambridge, Rochester; and over five hundred manufacturers of the United States. We understand that 1,200 of them are in use. They are now on exhibition at the Fair of the American Institute.

Further information may be obtained by addressing the Acid Pump and Siphon Company, New London, Conn.

The Fire Engineers.

The National Association of Fire Engineers convened in Boston, September 15. At its first session a report was submitted recommending organization on a plan based on the rules of the New York Fire Department. A report favoring the telegraph as the only reliable system for giving alarms was adopted. The second day Chief Hilliard, of Provincetown, in an essay on the firemen of the future, predicted the placing of the fire service on the same level with the army and navy as a means of public protection. The fact that pipes carrying low pressure steam will give rise to fires when in contact with wood, was held by Chief Hopkins to be fairly well established.

The protection of theaters and other places of public gatherings was considered in a report by Chief Engineer Green. He recommended the close and careful official supervision of such buildings during their construction. Theater stages, with their large area of inflammable properties, could and should be entirely separated from the auditorium by brick walls extending to the roof, with a gauze or iron drop. The latter should likewise be used to separate the stage and the auditorium, with ventilators over both, inclosed mainly in double-thick glass, which would answer for ventilation and would shut out cold air. The glass, in case of fire, would be broken by the heat, and the hole thus made would act as a chimney to let out the dense smoke and flame. Chief Nevins, of Brooklyn, favored the placing of such structures directly under the supervision of fire engineers with discretionary powers.

Charles S. Halloway, of Baltimore, made a report on the topic "Spontaneous Combustion," narrating a number of incidents illustrating the frequency of fires from this cause.

The drill of children in the public schools was next considered, Chief Combs, of Worcester, submitting a report in which he urged that more attention be given to this matter by school teachers. He advised the drilling of children, and thought that a drum should be kept in every school building, to be beat on only in case of fire, as a signal for the children to fall into line and march to the ordinary place of egress under the command of their teachers.

Other committees reported the advisability of the passage of State laws requiring buildings in business sections of cities to be fireproof and insuring better protection to people living in tenement houses.

In a valuable paper on the mutual relations of the fire engineer, the architect, and the underwriter, Mr. Edward Atkinson, of Boston, pointed out many common faults in the construction of buildings used for manufacturing and storage purposes. Chief among these are elevators, flues, and other air-connected spaces through which flames spread rapidly from floor to floor. The precautions against fire insisted on by the Boston Manufacturers' Mutual Fire Insurance Company have reduced the losses on mills, factories, and similar properties to one-tenth of one per cent on the amount of risks taken. A good word was said for petroleum, which is popularly supposed to increase the risk of fire. Mr. Atkinson said that the introduction of petroleum oils has been in many ways of benefit to the Mutual Insurance Company. About one-fourth of the factories insured therein are lighted with kerosene oil, but great care is taken to get the safe lamps and safe oil. Factories lighted with the vapors of gasoline are not insured at any rate. But the great value of oils made from petroleum in cotton factories is that they are "absolutely free from liability to spontaneous combustion," and one great source of danger has been removed by thir introduction."

Mixing of White with Colored Light.

It was noticed several years ago that when white light was mixed by the method of rotating disks with light of an ultramarine (artificial) hue, the result was not what would naturally have been expected; for, instead of obtaining a lighter or paler tint of violet blue, the color inclined decidedly toward violet, passing, when much white was added, into a pale violet hue. Two attempts have been made to account for this curious fact: Brücke supposes that the light which we call white is really to a considerable extent red, and that the mixture of this reddish white light with the blue causes it to change to violet. Hubert, on the other hand, reaches the conclusion that violet is really only a lighter shade of ultramarine blue. He starts with the assumption that we obtain our idea of blue mixed with white from the sky, which, according to him, is of a greenish-blue color. We then apply, as he thinks, this idea to the case of a blue which is not greenish, namely, to ultramarine blue, and are surprised to find the result different.

Prof. O. N. Rood, of Columbia College, shows, in a paper in the *American Journal of Science and Arts*, that these explanations are hardly correct, since they fail to account for the changes which, according to his experiments, are produced in other colors by an admixture of white. Prof. Rood prepared a set of brilliantly colored circular disks which represented all the principal colors of the spectrum and also purple. These disks were then successively combined in various proportions with a white disk and the effects of rapid rotation noted, a smaller duplicate colored disk uncombined with white being used for comparison. It was thus found that the addition of white produced the following changes: Vermilion became somewhat purplish; orange became more red; yellow, more orange; greenish-yellow was unchanged; yellowish-green became more green; green became more blue-green; cyan blue became less greenish, more bluish; cobalt blue became more of a violet blue; ultramarine (artificial) became more violet; and purple became less red, more violet. Exactly these same effects can be produced by mixing violet with the foregoing colors.

These experiments, says Prof. Rood, seem to explain the singular circumstance that when complementary colors are produced by the aid of polarized light, it is difficult or impossible to obtain a red which is entirely free from a purplish hue, a quantity of white light being always necessarily mingled with the colored light. "In the case of the red, orange, yellow, ultramarine, and purple disks, I succeeded in measuring the amount of violet light which different proportions of the white disk virtually added to the mixture, and found that it is not directly proportional to the amount of white light added, but increased in a slower ratio, which at present has not been accurately determined. For the explanation of the above phenomena, Brücke's suggestion that white light contains a certain amount of unneutralized red light is evidently inapplicable, since the effects are such as would be produced by adding a quantity not of red, but of *violet* light, and for the present I am not disposed to assume that white light contains an excess of violet light. The explanation offered by Hubert does not undertake to account for the changes produced in colors other than ultramarine, and even in this case seems to me arbitrary. Neither have I succeeded in framing any explanation in accordance with the theory of Young and Helmholtz which seems plausible."

Method of Examination for Color Blindness.

The following is the order issued by the Surgeon General of the Navy for the examination of seamen for color blindness:

"Upon the receipt of this order and the colored worsteds to be used as tests, medical officers of ships and stations will make a careful examination of all persons in the navy as to their color sense, the result to be reported to this Bureau according to the accompanying form. Quarterly returns will also be made of the result of the examinations of those who shall be hereafter examined for the service.

"The method to be employed is that of Holmgren, and for this purpose a set of test wools is supplied, which contains three large skeins, 'test colors,' green, purple (pink), and red, and a number of small skeins, the 'confusion colors.'

"The usual mode of examination is by Holmgren's method, which may be briefly described as follows:

"The worsteds are placed in a pile in the center of a piece of white muslin which is spread out on a flat surface in a good daylight. The green test skein is placed aside upon the white cloth, and the person to be examined is directed to select the various shades of the same color from the pile, and place them by the side of the sample. The color blind will make mistakes in the selection of the shades; or a hesitating manner with a disposition to take the wrong shades may show a feeble chromatic sense. The purple test skein is then used. If the test with the green skein has shown the person examined to be color blind, and on the second or purple test he selects only the purple skeins, he is *incompletely* color blind; but if he places with the purple, shades of blue or violet, or both, he is completely *red blind*. If, however, he selects to be placed with the purple, shades of green or gray, he is completely *green blind*.

"The red test skein need not necessarily be used, but it may be employed to confirm the diagnosis already made, for the red blind will select to match the red skein, shades of green or brown which to the normal sense seem *darker* than the red, while the *green blind* will select the shades of green or brown which seem lighter."

The Slow Development of Sugar in Cane.

"Observer" contributes to the New Orleans *Times* the following observations made by him last year, showing the gradual development of sugar in cane

August 12, wet weather, green joints, no sugar, lower joints polarized 4·8 per cent sugar.

August 19, dry weather, green joints, no sugar, lower joints polarized 8 per cent sugar.

August 21, wet weather, lower joints polarized 8 per cent sugar.

August 28, dry, cool nights, upper joints polarized 4·8 per cent sugar, lower joints polarized 9·6 per cent sugar.

September 10, wet weather, white cane, upper joints polarized 4·8 per cent sugar, white cane lower joints polarized 9·6 per cent sugar.

September 17, dry, bright, cool nights, purple cane, upper joints polarized 6 per cent sugar, lower joints 10·4 per cent sugar.

September 23, dry, sultry, warmer nights, upper joints polarized 8 per cent sugar, lower joints 13·6 per cent sugar.

September 30, dry weather, lower joints polarized 13·6 per cent sugar.

Early December cane of the following description was found, the ground being low and badly drained, and the cane very crooked at the same time: Density, 11·2 per cent (6·2° B.); polarized 8 per cent sugar, which is equal to 71·43 per cent sugar, and 28·57 per cent not sugar.

Juice like this would yield more than half molasses, from whatever percentage extracted out of 100 pounds of cane.

The juice of suckers had a density of 10 per cent (5·56 B.), and polarized 8 per cent, therefore poor in saccharine, but not inferior as to quality. Some planters seem to be made happy by suckers, but the foregoing analysis shows that there may easily be too much of a good thing.

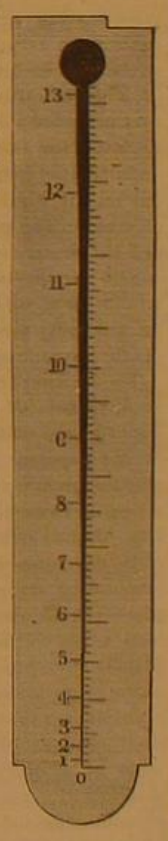
The lower part of good, sound cane showed juice of a density averaging 15 per cent with a polarization of 13·5. This would have been very good if three-eighths of the cane had not been as inferior as the above crooked cane.

From these observations, taken, however, as examples only, it can be seen that cane grown in well drained or easily drying lands, may be as good or even better the 1st of September than cane grown on low marshy soils by December.

STANDARD WIRE GAUGES.

BY M. W. GRISWOLD.

As all civilized nations divide the circle into 360 degrees, and as there can be no variation in any of these, nothing can be more standard than to take one of these angles for a wire gauge, an angle that everybody is familiar with and recognizes as fixed. But with this to begin with, no good would result if we were to select a certain size wire to start with, and then regulate all the other sizes from that (as in the old so-called standard gauges of the present day). This might perhaps do if all makers were to guess alike on their starting size. The metric wire gauge shown in the engraving starts at the center of the circle (or apex of the angle), which having no size is called 0, and to fix upon the points for the other numbers, the metric system is adopted as being a standard measure, and from 0 both sides of the angle are graduated so that one millimeter from the center gives No. 1; from No. 1 two millimeters for No. 2; from No. 2 three millimeters for No. 3; from No. 3 four millimeters for No. 4 (10 mm. from 0), and so on in arithmetical progression with one millimeter as the common difference.



With this gauge there is no guesswork in fixing upon a size, either to start with or to carry out the system indefinitely; and when referred, the exact diameter of any number can be easily calculated without measuring, if one prefers to do so, or does not happen to have a rule at hand.

The metric measure is adopted here, as it is evidently coming into quite general use, Spain having put it into full force throughout her entire possessions on July 15, and Turkey having gone so far as to recognize it.

If the wire consumers were to adopt this metric wire gauge and order from its numbers, the wire drawers would undoubtedly yield to the popular demand.

Mascart's Observations on Atmospheric Electricity.

The apparatus employed by M. Mascart for the measurement of atmospheric electricity is a Thomson's electrometer, in which the deviations of the magnetic needle are mechanically recorded by a pen.

The curves found by means of this apparatus, as described in a recent paper before the French Academy, proved that the potential electricity of the air is generally positive, especially when the sky is clear. On a cloudy day this electricity is diminished, changes rapidly, and is from time to time negative. Rain nearly always produces great deviations. An approaching storm is usually indicated by great negative variations, followed by very extended oscillations, a tendency toward negative electricity being predominant. Rains accompanied by positive electricity are extremely rare, and scarcely ever appear except during storms.

The intensity of the atmospheric electricity, which under ordinary circumstances is always positive, is by far greater and more uniform during the night than during the day. From 9 o'clock P.M. until 3 o'clock A.M., it varies but little: it decreases at sunrise, reaches its minimum against 3 o'clock P.M., rises again rapidly, and attains its maximum at about 9 o'clock P.M. The amplitude of the daily oscillation is much smaller during the winter than during the summer months.

A connection between the electric condition of the air and the temperature seems to exist, but several years may yet pass before this relation can be determined with certainty.

The fact that the maximum intensity occurs at night is contrary to the generally adopted law. According to the observations of Quetelet, in Brussels, two maxima of atmospheric electricity have been held to exist, one in the morning and one in the evening; and also two minima, one during the day, the other during the night. It is of the greatest importance that the observations of M. Mascart have corrected this erroneous assumption, which seems to be based upon imperfect observations.

The direct observation of atmospheric electricity has hitherto been made chiefly during the day hours, and the relative maxima found morning and evening have led to the erroneous assumption that a minimum of electric intensity occurred during the night.

Another very common source of error has also been overlooked, viz., the imperfect insulation of the apparatus. Care should always be taken that the glass supports of the apparatus are not exposed to the changes of the atmosphere. Many wrong observations have probably been caused by neglecting this precaution.

American Public Health Association.

The Executive Committee of the American Public Health Association have announced that the eighth annual meeting of the association will be held in New Orleans, December 7–10. Papers will be presented on abattoirs, epidemics, life insurance in its relation to the public health, the storm water question in city sewerage, the sanitary engineering problems of the Mississippi River, the hygiene of emigrant ships, the prevention of venereal diseases, voluntary sanitary associations, etc. The special questions suggested for discussion at this meeting, in addition to those connected with the papers above referred to, relate to methods of preventing the spread within a town or city—after they have once been introduced—of such contagious or spreading diseases as diphtheria, scarlet fever, yellow fever, measles, small pox, etc., and are as follows: What are the best means of securing prompt and reliable information as to the presence and location of cases of such diseases? What are the best means of securing isolation of the first or of single cases of such diseases, and what are the chief difficulties in securing such isolation? Under what circumstances is it proper to declare such diseases epidemic in a place? Under what circumstances is it proper to recommend the closure of schools on account of the prevalence of such diseases? What precautions should be taken at the termination of each case as to the care and disposal of the dead, the disinfection and cleaning of the room and house, and the period of time at which it is safe to allow the convalescent to return to school or society? Brief, practical papers upon any or all of these points are earnestly requested. Notice of intended papers should be sent to the president, Dr. J. S. Billings, Washington, D. C., or to Dr. E. H. Janes, Secretary, New York.

The Danish Butter Industry.

The Danes have made a marked advance in the butter industry by introducing the following measures:

1. Complete change of the butter season, which commences now on the 1st of November and ends on the 31st of August. In this manner the Scandinavian farmers produce the maximum of butter at the moment when the prices are the highest. While the butter of other countries pours into the London market during the spring and summer, the butter from the North occupies that place during the winter, a season when the scale is the most remunerative.

2. Introduction of Swarz's system into the dairies, *i. e.*, cooling the milk on ice, skimming after twelve hours, mathematical regulation of the churning, working and other manipulations, substitution of long and cylindrical vessels of polished sheet iron instead of little flat bowls of wood, and daily churning.

3. Fabrication of sweet butter, *i. e.*, butter churned immediately after the skimming.

The Racing Record Again Surpassed.

At Chicago, September 18, the celebrated trotter Maud S. surpassed the previously unparalleled record of St. Julien at Hartford (2:11¼) by half a second, making a mile in 2:10¾. On the same day, at Sheepshead Bay, Ferida beat by a quarter of a second the best time on record for a four mile race. The time was 7:23½. For twenty-five years the best time has been Lexington's, at New Orleans, 7:23¾.

Electricity from River Currents.

An inventor of this city proposes to utilize the swift current of rivers by systems of anchored floats carrying current wheels connected with electro-dynamo-machines. The electricity thus generated might be conveyed to factories on the shores and set to work by means of electro-motors; or it might be used for lighting towns, or even for running trains on railways.

AN IMPORTANT SHOE MACHINE PATENT CASE.

A decree just made by Judge Samuel Blatchford, in the U. S. Circuit Court for the Southern District of New York, is of especial interest to all boot and shoe manufacturers. The case was that of the McKay Sewing Machine Association against the Scott Sole-Sewing Machine Company, and differs from a suit recently noticed in these columns relative to the same subject matter, in that there was now no question of a license or contract between the defendant company and the complainants. Considering the matter at issue in the latter trial only as involving the validity of earlier patents which the McKay Association own, and the question of the infringement of the same by the defendants, the Court has now ordered an injunction restraining the defendants from "making, using, or selling any boots or shoes" such as described in patent 29,562, issued in 1860, and since extended to August 14, 1881, or which "embody any of the improvements or inventions described and claimed therein, and from participating in or aiding in such manner and sale."

This case presents some peculiar features, aside from its being one of great importance, as involving the interests of large numbers of manufacturers engaged in one of our leading industries. Prior to the summer of 1858, nearly all sewed boots and shoes, except those with very thin uppers and light soles, called "turns," were made with a welt; that is, the inner sole had a light thread of leather cut therefrom in which the seam was laid, after which it was tacked to the last, the edges of the upper drawn over it, a narrow strip of leather, called the welt, sewed to both inner sole and upper, and to this welt the outer sole was sewed, all of the work being done from the outside. This, to-day, constitutes the way of making hand-sewed boots and shoes. In 1858 Lyman R. Blake patented a machine by which, from a horn or arm working inside the shoe, the stitches were taken directly through the innersole, the edge of the upper, and the outsole, without the insertion of any welt. This machine works very rapidly, immediately came into general use, and makes the greater proportion of what are now known as machine-made shoes. Within two years from making public his invention the inventor obtained subsequent patents, one covering the shoe itself as a new article of manufacture, and the other covering the process of making, both as independent of what had been secured to him by the patent on the machine. The defendants submitted evidence to show that boots and shoes had previously been made by hand by sewing through from outside to inside of the sole, but the Court considered that the way in which this was done, so far as set forth, made something of a different product, or was not so far practical as to impair the validity of the Blake patent for doing this work in the way it was performed by the machine.

It would be difficult to find, in the history of successful patented inventions, a line of improvements so energetically prosecuted, and with such widely diffused advantages to the general public, as have been those connected with the sole sewing machine. Previous to its introduction there was little but coarse work made in shoe factories, and the custom shoemaker and the cobbler furnished nearly all the boots and shoes of the better class worn. Now, however, it is probable that at last nine-tenths of all the boots and shoes produced in this country are of factory production. The sole sewing machine stimulated improvements in other departments of the business, but those who have had control of the patents therefor have always been fully alive to the demands of the trade upon them, as the numerous subsequent patents obtained by the McKay Association fully attest. Their business has, of course, been immensely profitable; they do not sell the machines, but lease them at a nominal sum, the manufacturers being obliged to put license stamps on each pair made. These stamps are for half cent a pair for children's shoes, one cent for misses' and youths', two cents for women's and 3 cents for men's, and, from one of the affidavits presented on the trial, it appears that the shoes made under the licenses issued up to the 16th of August last, amounted to the immense number of 441,490,380 pairs. Taking the average price of the stamps at 2 cents a pair, the total receipts of the Association from this source would, in round figures, be about $9,000,000, but even this large sum would form a very inadequate measure of the benefit which the public has derived from the introdution of these improvements. The pegging machine cheapened the price of coarse boots and shoes, but the sole-sewing machine, with its advantages for factory use, was necessary to bring down the cost of all the better grades of goods, and it efficiently accomplished this work.

The Life and Death of a World.

Mr. R. A. Proctor, the celebrated astronomer, recently delivered a lecture on the "Life and Death of a World," in the Town Hall, Adelaide, South Australia. The *English Mechanic*, from which paper we extract, remarks that Mr. Proctor, in his exordium, pointed out that perhaps the chief point in which the science of our own times differs from that of former days consists in the fact that, on a wider scale than the ancients did, we recognize the presence of natural law. Where the ancients traced the law of development in the history of a plant, or perhaps in the growth of forests, we in these days with a larger vision saw that the same law was in force all through the works of creation. Applying it to the world in which we live, we saw how continents had risen up from the ocean, and how the earth had been fashioned by a slow process of development that might require millions of years for its complete fulfillment. Extending its vision still farther the science of to-day recognized the same processes of development at work in the solar system—nay, throughout the universe; and it saw, too, that operating on this gigantic scale incalculable periods of time were necessary for the completion of those processes. It was his purpose that evening to bring before his audience, in such a way that they would be able to accept it, the evidence of the truth that the various orbs forming the solar system of which our earth is one member were all in different stages of a world's life. To this end he began by dividing the history of a world such as ours into three distinct stages or epochs of development: the period of young life, the period of mid-life, and the period of old age. Each of the various members of the solar system, or indeed, the universe, was either now, or had once been, in the form of vapor at an intense degree of heat. Taking our own earth as an example, we could look back in imagination to that remote period when all the substances, liquid and solid, now forming the earth were in the shape of fiery vapors, and from the gigantic clouds they formed showers of molten metal, poured down as the planet gradually cooled; while in its intensely heated state the world would be expanded to a size immensely exceeding its present mass, and surrounded with thick, fiery clouds, holding all the present elements of our seas and continents in the form of vapor, but, as the world cooled down, the various metals, rocks, and other substances in the composition of the earth would gradually assume their present form. But still there would be such intense heat that one substance—water—would remain in the vaporous state, forming great belts of clouds, and, as the central nucleus of the growing planet continued to cool down, still further changes would take place. From the outside nothing would be visible but layers of clouds arranged in the order of rain clouds below, cumuli a little higher, and the light feathery clouds still further up. At last came the period of habitability, through which the earth is at present passing, and after that the period of decrepitude and decay, when from the intensity of cold no power of life could possibly exist. In order that we should properly appreciate the enormous length of time that all these stages of planetary development would require it was necessary that our conceptions of time should be enlarged like our conceptions of space, and just as we regarded space as infinite, and our little earth the merest point in the university of creation, so we needed to extend our ideas of time just as far in that direction. The geologist knew from what the rocks taught him that millions of years must have passed away simply during that period when the continents were being made and the rocks placed stratum by stratum as we found them in the present day; but the stages of a world's life before and after this one epoch in its history occupied incalculable periods of time. What time was required for these processes to be carried out could not be definitely settled. It was sufficient for his purpose to point out that it would probably be at least five hundred millions of years. The geologist told them that as the earth became old the waters would gradually diminish and the atmosphere would become too tenuous to breathe. Cavities would form, into which all the waters of the earth would be gradually soaked up; and at last, in the final stage of death, the atmosphere would disappear.

The lecturer then proceeded to show, by reference to the other planets of the solar system, how a criterion could be formed as to when a globe was in one or other of the stages of development he had indicated. The larger the planet was the greater time it would take in cooling down, and so when we came to Jupiter, whose diameter was seven times that of the earth, we should expect to find that every stage of its development would be seven times as long as the corresponding stage in the history of our earth. The larger planets must, then, be much younger than this world—or at least in an earlier stage of development—and the smaller planets very much older. Beginning with the sun, as the oldest body in our system, he pointed out that in development it was the youngest; and he showed that if five hundred millions of years had elapsed since the earth was a mass of glowing vapor, then three thousand five hundred millions of years would be required for the sun to reach the present stage of the earth. In the first stage the leading characteristic was intense heat, and every substance was in the form of vapor. So in the sun we found by the aid of the spectroscope that many of the substances in a solid and liquid state on the earth were there in a state of vapor. The next stage was represented by Jupiter and Saturn; the stage of mid-life by the earth and Venus; and the period of old age by Mars and Mercury. The last and final state—death—would be found exemplified in a still smaller body—the moon. Jupiter, one thousand two hundred and fifty times the size of the earth, and three hundred and forty times as massive, and Saturn, seven hundred times as large as the earth, and one hundred times as massive, represented the second stage of the earth's existence; and both in point of development were younger than the earth. If all the water on each were raised in the form of clouds our earth would appear greatly magnified in size to an inhabitant of Venus; and Jupiter presented exactly that appearance to us. One of the satellites of Jupiter had, on one occasion, been observed to pass inside the edge of the planet, and a few minutes afterward had been seen outside, as if it had suddenly stood still. If the visible surface of Jupiter was solid they would be required to believe that the crust of the planet had sunk three or four thousand miles—a change in its condition so momentous that the additional heat engendered would have arrested immediate attention. The real explanation was, according to the view he put before his audience, that all we saw of Jupiter was a vaporous substance raised above the planet itself, and the cloud masses enveloping it had passed away into the form of invisible vapor so as to leave the satellite within what had previously been the limit of the envelope. Through the edge of Jupiter a star could sometimes be seen, and probably the planet itself was thousands of miles below its apparent surface.

Referring next to Saturn, the lecturer pointed out that its condition corresponded with that of Jupiter; and he passed on to consider Mars, as an older planet, exemplifying the stage of decrepitude and decay. In that planet the area of the water surface had been reduced till it was only just equal to that of the land; and at the poles there were bright white caps which presented changes such as we should expect to see on the supposition that these caps were of snow. A chart of Mars, with its peculiar distribution of land and water, presented the appearance that the earth, according to calculations made on the basis of soundings taken by the Challenger, would have if half the water on its surface were absorbed.

Finally the lecturer dealt with the moon as illustrating the last stage of a planet's existence—that of death. That the moon had no atmosphere was shown by the extreme blackness of the lunar shadows. The atmosphere of the earth was illuminated, and its shadows were very different in appearance from those that were visible on the surface of the moon. The absence of water in our satellite was also clear; but the dark spots visible on its disk were shown to be low-lying levels where the water had been in the earlier stages of the moon's existence. The lecturer exhibited several magnificent diagrams depicting the utterly dreary aspect of the moon's surface, and he showed that millions of years hence, when the earth entered into the final stage of its history, it would present the same lifeless, arid appearance.

In conclusion, he remarked that the conception of the universe, as explained by him that evening, might appear to those who sympathized with the views of Brewster, Chalmers, and Dick, as to the existence of life in all the orbs around us, a conception at variance with our ideas of what was fitting.

On further consideration, he believed his audience would agree with him that the view he presented was not so cheerless as it appeared. If every orb in space was now inhabited the present stage must have been preceded by universal lifelessness, and would be followed by universal death; but if they accepted the view he had brought forward they would still be able to recognize that even now there are millions of worlds bearing life, like the planet of which we are the inhabitants. For space was infinite, and should there be only one life-bearing planet in every solar system, there would still be scope to conceive in the universe millions of worlds inhabited even at the present time. The number of stars visible through Lord Rosse's telescope could be no less than one hundred millions, but what instrument of human invention could fathom the infinity of the star depths? We were lost in the presence of the universe to which our reasoning had brought us. Laplace had said that the known was little, the unknown immense, but they might say with greater truth the known was nothing, the unknown infinity. As a fitting peroration for his lecture he recited the magnificent rhapsody of Jean Paul Richter, wherein the poet describes a man launched forth into space with an angel for his guide, and passing from constellation to constellation till his spirit aches with infinity, and the glory of God is insufferable. Then the angel raised his glorious hands to heaven and cried, "End is there none to the universe of God—Lo, also, is there no beginning!"

Utilizing Milkweed.

A writer in the Providence *Journal* predicts a useful future for the milkweed, which has heretofore been considered only a cumberer of the ground. Its seeds yield a finer oil than linseed; its gum can be used in place of India-rubber; and from its floss a fabric resembling Irish poplin has been made; while the young shoots are used in the spring by some people instead of asparagus, which they resemble in flavor. Now, pertinently adds the writer, if uses can be discovered for the thistle and whiteweed, they may prove friends in disguise.

An Exhibit on Wheels.

One of the features of Eastern fairs this fall is an exhibit car containing "Products of the Golden Northwest," furnished by the Northern Pacific Railway Company. In the collection are specimens of the agricultural productions of the country traversed by the road, stereoscopic views of scenery, native woods, and other objects likely to interest intending settlers. The car is run from fair to fair, and the exhibit is calculated to make a powerful impression.

A RETURN issued by the German Postmaster-General shows the number of post-cards used in Europe in the year 1878 to have been 342,000,000. Of that number 111,455,000 were posted in the United Kingdom, 108,741,000 in Germany, and 30,522,000 in France. In the United States during 1879, 246,000,000 cards were dispatched by the Post Office, and it is estimated that during 1880 the figure will rise to 300,000,000. The German postal authorities estimate the number of cards in use throughout the postal union at 700,000,000.

$200,000 WORTH OF RIFLES.

The Largest Transaction in Sporting Arms on Record.

A NOTEWORTHY EVENT TO ALL SPORTSMEN. The Evans Rifle Co., manufacturers of the world-renowned twenty-six shot Evans Rifle (whose factory is at Mechanics Falls), has been complimented by both American and foreign manufacturers as the most extensive and complete in the world, have taken a signal, and in the face of the advance in firearms, a most commendable step. The Evans is the most expensively made, and has hitherto been the highest priced of all magazine or repeating rifles, embodying as it does a marvelously ingenious action, and carrying in its magazine (which is entirely within the stock, necessitating no outward addition) twice the number of *larger* cartridges than any other arm. The Evans is a phenomenal shooter, being accurate up to 1,200 yards, and every shot can be discharged in less than *one minute*. This arm has commanded the admiration of every sportsman in Europe and America who has used it, and it is as common in the best hunting grounds of Germany and France as in our own West, which would be a remarkable fact, prone as foreign sportsmen are to use home-made weapons, if it was not that the Evans is the only repeating arm in existence carrying enough cartridges in its magazine for a whole day's sport, and having that magazine entirely concealed within itself *and in the stock*, where the weight should be, not under the barrel, varying the "hang" of the arm with every shot. To return to the subject, the Evans Rifle Company have run their factory to its utmost capacity for the past two years, and have thereby accumulated an immense stock of rifles made at the lowest possible figure obtainable under the most favorable circumstances. The price of the Evans has hitherto been $40 and upward, and it was well worth it; but now the Evans Rifle Company propose, though it is in the face of a fierce opposition from the trade, to reduce the price of their arm to $15 and $20, thus placing the finest and most complete repeating rifle in the world on the par pecuniarily with a common single shot rifle. The only reason for this reduction is a desire to place with the reach of all the best repeating rifle in the market, and supplant many of the cheap, unsafe arms now in use. This is a step all the more commendable from the opposition it has met with from the trade, who wished the former high prices and big profits maintained; and the thanks of all sportsmen are due to a company actuated by these motives, especially at a time when the tendency in all branches of trade is to unnecessarily advance prices and profits.

The Evans Rifle Company have transferred their entire product to the warerooms of the well known Boston house of G. W. TURNER & ROSS, whose facilities for conducting this immense sale are unsurpassed, and through that firm will be offered over six thousand of the new and latest improved model Evans rifles at half former list prices, and the sportsmen of all countries will not be slow in taking advantage of the offer. We refer the reader to the advertisement and the testimonials of such well known shots as A. J. Boyd, Texas Jack, and others.—*Adv.*

Business and Personal.

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

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

Chard's Extra Heavy Machinery Oil.
Chard's Anti-Corrosive Cylinder Oil.
Chard's Patent Lubricene and Gear Grease.
R. J. Chard, Sole Proprietor, 6 Burling Slip, New York.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms-vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Mr. Henry D. Hall (of the late firm of Hall & Benjamin) is now located with Messrs. J. & H. Berge. See their advertisement on page 236.

The Eureka Mowing Machine now is acknowledged as the best in the market. It has taken the first premium in nearly every State Fair this year. Prices to suit the times. Send for illustrated circular to Eureka Mower Company, Towanda, Pa.

For the Globe Street Lamp, address J. G. Miner, John St., Morrisania, New York City.

The Boomer & Boschert Press Co. have in daily operation, at the Am. Inst. Fair, a complete cider mill and cider jelly manufactory. New York Office, 15 Park Row.

50,000 Sawyers wanted to send their full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

H. W. Johns' Asbestos Liquid Paints are strictly pure linseed oil paints, and contain no water. They are the best and most economical paints in the world. Send for samples to the H. W. Johns Manufacturing Company, 87 Maiden Lane, New York, sole manufacturers of genuine asbestos materials.

Money wanted to secure Foreign Patents. Home patent allowed. Address Jeweler, Box 34, Whitakers, N. C.

Packing once tried always used. Phœnix Packing from 1-16 up in spools or on coils. Phœnix Packing Company, 108 Liberty St., N. Y.

Schenck's Planers and Matchers, Resawers, Scroll Saws, etc., etc. H. B. Schenck, Matteawan, N. Y.

Wanted, by a young Optician, a situation with a manufacturer of optical instruments. Chas. S. Minnich, Gratiot, O.

The great advantage of the genuine Asbestos Coverings for Steam Pipes, Boilers, etc., over any other forms of non-conducting coverings, aside from their superior effectiveness and fireproof qualities, is that they are manufactured in convenient form, ready for use, and can be easily applied without the aid of skilled labor. The H. W. Johns Manufacturing Company, 87 Maiden Lane, New York, are the sole manufacturers.

Electric Batteries, Wires, Bells, and Materials. Catalogue free. E. M. Wood & Co., Worcester, Mass.

Gas Machines.—Be sure that you never buy one until you have circulars from Terril's Underground Meter Gas Machine, 39 Dey St., New York.

Brick Presses for Fire & Red Brick, and Brickmaker's Tools. S. F. Miller & Son, 309 South Fifth St., Phila., Pa.

Eclipse Portable Engine. See illustrated adv., p. 189.

Small Brass and Iron Rivets made to order by Blake & Johnson, Waterbury, Conn.

Experts in Patent Causes and Mechanical Counsel, Park Benjamin & Bro., 50 Astor House, New York.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

4 to 40 H. P. Steam Engines. See adv. p. 189.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustrated advertisement. Send for their new circulars.

Sweetland & Co., 125 Union St., New Haven, Conn., manufacture the Sweetland Combination Chuck.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co., 52 Dey St., N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N. Y.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

For Yale Mills and Engines, see page 173.

Reed's Sectional Covering for steam surfaces; any one can apply it; can be removed and replaced without injury. J. A. Locke, Agt., 32 Cortlandt St., N. Y.

Burgess' Non-conductor for Heated Surfaces; easily applied, efficient, and inexpensive. Applicable to plain or curved surfaces, pipes, elbows, and valves. See p. 284.

Blake "Lion and Eagle" Imp'd Crusher. See p. 205.

Peck's Patent Drop Press. See adv., page 204.

C. J. Pitt & Co., Show Case Manufacturers, 226 Canal St., New York. Orders promptly attended to. Send for illustrated catalogue with prices.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 205.

Saw Mill Machinery. Stearns Mfg. Co. See p. 205.

Improved Solid Emery Wheels and Machinery, Automatic Knife Grinders, Portable Chuck Jaws. *Important*, that users should have prices of these first class goods. American Twist Drill Co., Meredithville, N. H.

Leather and Rubber Belting, Packing, and Hose Greene, Tweed & Co., 118 Chambers St., N. Y.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

The $4 Drill Chuck sent free on receipt of price. A. F. Cushman, Hartford, Conn.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 220.

For Wood-Working Machinery, see illus. adv. p. 221.

For Separators, Farm & Vertical Engines, see adv. p. 220.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 221.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

Blake's Belt Studs are best and cheapest fastening for all belts. Greene, Tweed & Co., N. Y.

For Patent Shapers and Planers, see ills. adv. p. 220.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 141.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 221.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 221.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 221.

Penfield (Pulley) Blocks, Lockport, N. Y. See ad. p. 221.

Wiley & Russell M'f'g Co. See adv., p. 190.

NEW BOOKS AND PUBLICATIONS.

INFORME QUE EL DIRECTOR DEL OBSERVATORIO METEOROLOGICO CENTRAL PRESENTA A LA SECRETARIA DE FOMENTO ACERCA DE LOS TRABAJOS VERIFICADOS EN AQUELLA OFICINA DURANTE LOS ANOS DE 1878 Y 1879. Mexico, 1880.

This is a beautifully printed pamphlet of 88 pages, giving a full report of the work accomplished by the Mexican Observatory during the years 1878 and 1879. From it we learn that the observatory does not confine itself strictly to astronomical work, but extends its operations to the investigation of the physical conformation of the country and to its natural productions. The relations of the climate to the health of the people; the distribution of plants and their time of flowering and perfecting their seeds; the influence of the atmosphere on the vital phenomena of plants; geographical explorations, etc., all come within the scope of this scientific institution's labors. This report is interesting as showing how much has been accomplished by the observatory during the comparatively short time that it has been in operation, as well as how great an advance in science our Mexican neighbors have made during recent years; and the account of the work herein given is the best proof that could be afforded of the importance and utility of an observatory like that which is so ably presided over by Professor Mariano Barcena.

REPORT ON THE GEOLOGY OF THE HENRY MOUNTAINS. By G. K. Gilbert. Washington: U. S. Government Printing Office.

The Henry Mountains are in Southern Utah, on the right bank of the Colorado of the West, and are a group of five mountains separated by low passes and arranged without discernible system. The highest rise about 5,000 feet above the surrounding plateau, their extreme altitude above the sea being somewhat over 11,000 feet. They were named after the late Professor Joseph Henry, and offer an exceptionally favorable field for the study of structural geology. As described by their explorer they mark a limited system of disturbances, which interrupt a region of geological column, and structurally as well as topographically stand by themselves. All the Henry Mountains exhibit dome like uplifts caused by a peculiar intrusion of porphyritic-trachyte between and under strata ranging from carboniferous to cretaceous. The igneous rock, instead of overflowing the surface and forming mountains in the usual way, stopped at a lower horizon and formed a vast cistern deep below the surface, lifting up the superior beds. The essential element of this type of mountain structure is called by M. Gilbert the laccolite, the study of which furnishes a novel and most suggestive chapter in structural geology.

REPORT ON THE LANDS OF THE ARID REGION OF THE UNITED STATES. By J. W. Powell. Second Edition. Washington: Government Printing Office.

The arid region of the United States comprises the larger part of the great Rocky Mountain region, where the mean annual rainfall is insufficient for agriculture. A small percentage of the area is irrigable, about a quarter is timber land, and the rest is divided between pasture lands and deserts. Professor Powell and his assistants treat of the physical characteristics and requirements of these different classes of land, as regards settlement and utilization, rainfall, water supply, the lands of Utah, land grants in aid of internal improvements, etc.

THE ENGINEER'S HANDY BOOK. By Stephen Roper. Philadelphia: E. Claxton & Co. pp. 678.

A well-made pocket book of practical information for mechanical engineers, particularly those of limited education, and such as may wish to qualify themselves for service in the U. S. Navy or the mercantile marine. The more important engines in use are clearly described and formulæ are given for estimating their power. Particular attention is paid to the Steam Engine Indicator, its use and advantages. The author has had much experience in this class of work, and writes clearly and plainly.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

(1) J. H. G. writes: I built a skiff after the plans in No. 26, SCIENTIFIC AMERICAN SUPPLEMENT, and it is a good one. I built it strictly to the plans except the rowlocks. I took a piece of 2x4 hard pine, 26 inches long, and had a pair of thole pins made to go in; the pins were 5 inches long in the shaft part. I like it better than your plan. The boat proved to be a good one. It runs easy, and takes but little water and sets flat, so that with one in the stern and the oarsman, it does not stand up in the bow out of the water and look ridiculous. One thing about this boat, it will not tip or upset—safe in every way. Please give me a solution of the figures representing the tables in No. 39, for the sailing canoe? For instance, in table No. 1: rib, 8 5—rib A and 1, 15·62. I, being an amateur boat builder, do not understand these figures. A. These figures are the distances from the center line to the outside of frames on the several horizontal lines shown in first diagram. 2. Is there any process by which nickel plating can be done by friction, same as can be done by the amalgam of a looking glass? If so, where can the nickel powder be procured? A. Nickel cannot be applied in this way.

(2) B. R. writes: I am building a steam yacht which is forty-five feet long over all. I have her planked, and wish to know what would be best to calk her with, and if marine glue would answer the purpose of pitch for the seams, and which of the two would you advise me to use? A. We think marine glue would answer your purpose well. 2. What size boiler and engine would I require with a 40 inch screw? A. Engine 8 inch cylinder by 8 inch stroke; boiler 46 or 48 inches diameter by 6 feet high.

(3) C. H. H. asks: What degree Fah. would rightly express the temperature of an object which is four times as cold as ice, supposing ice to be just at 32° Fah.? A. According to popular usage, 96° Fah., or 96° below zero. The expression is, however, incorrect, since the word cold implies the absence of heat.

(4) R. M. writes: 1. I am going to build a hunting and fishing boat, about 4 feet wide by 14 feet long, decked over, and to weigh between 300 to 400 lb., and I want to know if I could use a screw propeller worked with gear wheels and operated by hand? A. Yes. 2. If so, how large should the propeller be, and how many revolutions should it make? I don't care so much for speed as I do for the convenience. A. 14 to 16 inches diameter. It should be geared to make 300 to 350 revolutions per minute.

(5) J. W. B. asks: Can engravings be transferred to mother of pearl? If so, how? A. Coat the shell with thin white copal varnish. As soon as the varnish becomes sticky place the engraving face downward on it and press it well into the varnish. After the varnish becomes thoroughly dry moisten the back of the engraving and remove the paper very carefully by rubbing. When the paper is all removed and the surface becomes dry, varnish lightly with copal.

(6) A. H. E. asks: By what process can beeswax be cleaned from comb and other substances which do not belong in it? A. Agitate it with about five times its weight of boiling soft water, cool, collect the wax, remelt and pass it through a fine linen strainer. It may be bleached by agitating it with hot water containing a small quantity of chloride of lime (wax 56, water 56, bleaching powder 7 lb.). When it has become white it is purified from the lime by the addition of a sufficient quantity of hot dilute sulphuric acid (acid 1, water 9), then repeatedly boiled with plenty of fresh water, collected, fused at a gentle heat, and kept in this condition until all adhering water has been driven off.

(7) G. A. L. asks if crude petroleum is what is used for fuel for steam boilers. Can I get what I want at the oil refineries, and is it more or less explosive than kerosene oil? Is there any danger of explosion from an open tank if kept cool? A. Generally crude petroleum is used for fuel; it is more explosive than kerosene used in lamps. There is great danger in having a light or fire near an open tank.

(8) F. E. K. writes: In the fall of 1877, while experimenting with the then comparatively new Bell telephone upon a metallic circuit, several hundred feet long, it occurred to me to pass the current through the body of a person. Cutting the line and placing the ends in the hands of my assistant, much to my surprise was able to talk with much distinctness. Other persons were added until four were included in the circuit, the volume diminishing with each addition. I then took the terminals of the line in my hands, and, with the telephones in a convenient position, actually transmitted my own voice through my own body, and distinctly heard the voice of the person at the other end of the line after it had passed through my own body. Physiologists can here find a wide and interesting field.

(9) F. S. asks: 1. Can I learn engineering from books alone, studying at home. If so, what books are required? Name some, please, for a new beginner. A. No; but you can with advantage study engineering books, while going through a practical education in a good workshop. "Bourne's Catechism of the Steam Engine" and "Roper's Catechism of Steam Engine" are suitable to begin with. 2. Is it necessary to serve an apprenticeship as machinist? If so, how long? A. Yes; the length of time depends upon the ability, attention, and energy of the apprentice.

(10) C. M. B. asks: 1. Which will draw the hardest, a wagon with a small axle or one with a large axle? A. Large. 2. Which will shoot the farthest, a rifle or a smooth bore, with the same powder? A. Rifle.

(11) J. P. P. asks: What will be the amount of water that would flow through half and three-quarter inch gas pipe, say two miles long, with from 400 to 600 feet fall to the mile? I wish to set my mill at the foot of mountain, and bring the water down for steam and for use about the houses, etc. A. Half inch pipe under 600 feet head, 3·4 cubic feet per minute; three-quarter inch pipe, under 600 feet head, 9·4 cubic feet per minute.

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

A. J. L.—An impure fire clay. Might be useful for the manufacture of cheap pottery, drain pipes, tiles, etc. —J. C. H.—Chiefly clay—probably contains a small amount of lime phosphate.—A. S.—The powder consists chiefly of mica scales.—A. P. W.—Quartz with mica scales—probably contains traces of gold.

English Patents Issued to Americans.

From September 3 to September 7, 1880, inclusive.

Amalgamator, P. B. Wilson, Baltimore, Md.
Belting for machinery, G. S. Long, Hartford, Conn.
Cigarette machine, C. G. & W. H. Emery, N. Y. City.
Cigarette machine, E. Side, Brooklyn, N. Y.
Packing boxes, machinery for manufacture of, F. Myers, New York City.
Packing boxes, machinery for dressing the edges of, F. Myers, New York City.
Printing upon wooden cases, F. Myers, New York City.
Shutters, revolving, J. G. Wilson, New York City.
Valve, J. T. Hancock, Boston, Mass.

[OFFICIAL.]

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September 7, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1836, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1836; but at increased cost, as the specifications not being printed, must be copied by hand.

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Vol. XLIII.—No. 16. [NEW SERIES.] NEW YORK, OCTOBER 16, 1880. $3.20 per Annum. [POSTAGE PREPAID.

AMERICAN INDUSTRIES.—No. 58.

THE MANUFACTURE OF NON-CONDUCTING COVERINGS FOR STEAM PIPES, BOILERS, ETC.

All questions which touch the relation of the actual amount of power in a pound of coal to that which is practically obtained therefrom, are just now receiving closer attention than ever before. The fact that, in the average working of the better classes of steam engines in general use, we only obtain about ten per cent of the value of the heat that is expended in the furnace, has long been known, but the various styles of compound engines, the Loftus Perkins system, and all the thousands of inventions and improvements in furnaces, engines, and boilers, for more completely obtaining the full power of the coal consumed, have fallen so far short of success as to leave the question of its perfect utilization almost untouched. The principal difficulties in the way of making and using steam at about the temperature of the furnace fire, which would obtain the theoretical value, excepting losses in combustion, are of a mechanical nature, as it has thus far been found practically impossible to work under the high pressures this would give. But the way in which the temperature and the pressure of steam, in our ordinary boilers and engines, are allowed to drop in the steam chest, cylinders, and pipes after it leaves the boilers, as well as the loss in the boiler itself from the diminution of heat by radiation, indicates a want of economy in one of the simplest matters of detail, where comparatively inexpensive provisions would many times repay their cost.

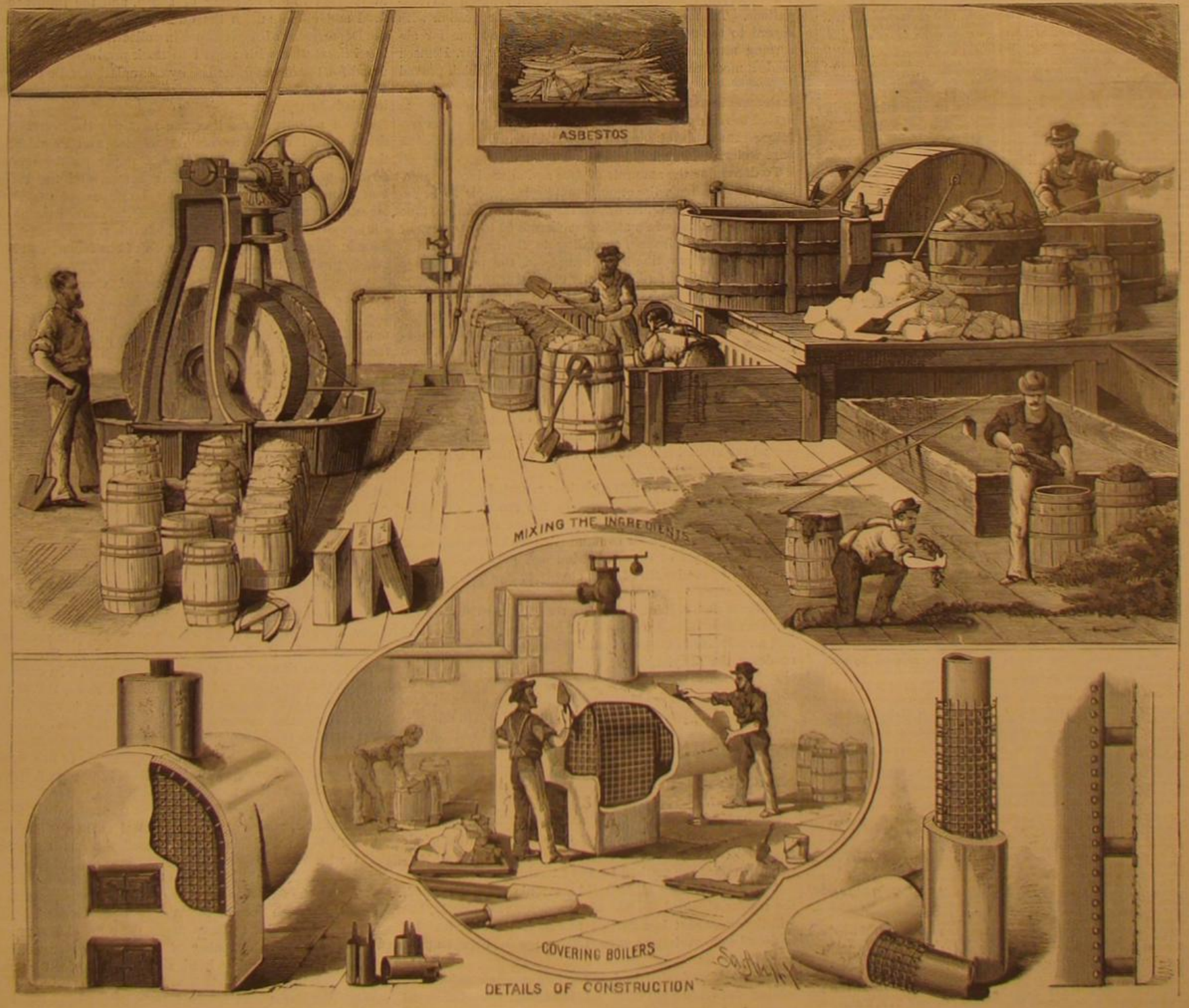
In the illustrations below we show the processes followed in making the Chalmers-Spence non-conducting and "air space" coverings for boilers, steam chests, cylinders, pipes, etc., through the proper application of which the loss of heat by radiation may be almost entirely prevented. The name of the company is taken from the patentees, Messrs. Chalmers and Spence, who were first to make a practical success of this method, and it has now been in use sufficiently long to have thoroughly demonstrated its efficiency, the list of testimonials which the company shows embracing not only the engineering department of the United States Navy, but hundreds of the largest steamship companies and manufacturing establishments in the country. These coverings have also been applied with great success on the hot air pipes of blast furnaces, and wherever hot air is to be conveyed to a distance, their use in this way offering relatively the same advantages as are obtained when steam pipes are thus covered.

In most of these coverings asbestos is used in larger or smaller proportions. Its strong yet delicate fibers, with the fact that it is entirely unaffected by fire, peculiarly fit it for this purpose. It is a variety of hornblende and pyroxene, generally of a clear or grayish-white, and is mined to some extent in almost every part of the world, our supplies coming principally from the Mediterranean, China, and Canada. The view at the left shows a mill for crushing the asbestos, care being taken that in this operation there shall be no friction or attrition from the rollers to grind the material or break its fibers.

As generally applied in the coverings of boilers, cylinders, tubes, etc., the asbestos is made into a kind of plaster with a mixture of hair and other materials, and this portion of the work is shown so that it will be easily understood by a reference to the engraving. The tearing up of the hair, the tank, barrels, and piles of material ready to place in the revolving drum, and the barrels in which the prepared mixture is received as it comes out, give a graphic idea of the process.

The view at the bottom of the page illustrates various ways of putting on the covering. In the center the workmen are seen applying it with trowels around a boiler, very much as a mason would plaster a room. At the left is a boiler thus covered, with a section torn off to show a portion not covered, and to the right stands a pipe on which the "air space" covering has been applied at the bottom, while above and around the pipe is shown the wire cloth frame on which the covering is plastered. This frame is kept at the proper distance from the pipe by studs of a greater or less length, according to the amount of air space it is intended to leave around the pipe, and the covering is plastered on this frame,

[*Continued on page* 244.]



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Scientific American.

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NEW YORK, SATURDAY, OCTOBER 16, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 250,

For the Week ending October 16, 1880.

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ORGANIC MATTER IN THE AIR.

About a year ago, at the request of the National Board of Health, the well known and very capable chemist, Prof. Ira Remsen, undertook an investigation of the methods employed for the detection and determination of the nature of the organic matter known to exist in air. A preliminary report, giving an outline of the work, but no details in regard to the methods employed, was published in the *Bulletin* of the Board last winter.

In the *Bulletin* for September 11, appears a more extended report, with details of experiments and such results as seem to have been established by them. The importance of the work, in which Mr. Remsen has been assisted by Mr. W. Mager and Mr. T. W. Day, will be appreciated by all who have any knowledge of the grave questions of public and private hygiene which hinge upon the possible influence of organic matter in the air, and the great need of some trustworthy and if possible simpler method of detecting its kind and measuring its quantity.

While air is often contaminated by carbonic acid and other gaseous results of vital, chemical, and industrial processes, the mischievous effects of "impure air," as popularly defined, most probably arise from the presence of refuse organic matters of a nitrogenous character. These, when taken back into the system, are apt to cause serious vital disturbances, and it is probable that they do cause not a few of the maladies which afflict mankind. The great problem is to discover the best method of determining the presence and nature of such impurities in air.

The first to attack the problem seriously was Dr. R. A. Smith, of Manchester, England, as early as 1870. He first endeavored to collect the organic matter in the air of city streets and foul places by washing the air in pure water. In some cases as many as a thousand volumes of air were successively washed with one volume of water, a process which required infinite patience and care, and so much time as to forbid its use as a practical method.

A different and more complicated though less laborious method of washing air, more recently devised by Mr. E. M. Dixon, Chemist of the Sanitary Department of Glasgow, has yielded valuable results, both there and at the Observatory of Montsouris, near Paris.

Something more simple and accurate, however, seemed requisite for general use; and the devising of such a method was accordingly made the first step of Mr. Remsen's investigations. Taking advantage of Chapman's suggestion with regard to the use of finely powdered pumice stone for absorbing nitrogenous organic matter from air, Mr. Remsen made a modification of Chapman's apparatus, which proved at once simple, efficient, and reliable in its results. Before each experiment the coarsely powdered pumice stone was heated to redness in a platinum crucible, then put into carefully cleansed absorbing tubes, and moistened with a little pure water.

To determine the amounts of free and albuminoid ammonia obtainable from the organic matter in the air to be examined, the air was first drawn through the pumice stone absorber by means of an aspirator. From 50 to 100 liters of air were drawn through, according to the amount of impurity. The absorption being completed, the pumice stone was conveyed to a flask perfectly cleaned with pure water; then 500 c.c. of the same water and 5 c.c. of a specially prepared sodium carbonate solution were added. Connection was then made with a clean condenser, and 100 c.c. distilled off (distillate A) and put aside for treatment with Nessler's solution. A second distillate (B) of 100 c.c. was then made, after adding to the contents of the flask 20 c.c. of a specially prepared solution of potassium hydroxide and 50 c.c. of a solution of permanganate of potassium. The first distillate Nesslerized gave the free ammonia, and the second the albuminoid ammonia, in the volume of air drawn through the absorbers.

In the course of the investigations reported upon, to determine the variations produced in the amount of nitrogenous organic matter in air by different causes, experiments were made with air contaminated with decaying meat in various stages of decomposition and dryness, air contaminated by the breath of dogs closely confined, laboratory air, etc.

Hitherto the opinion has been that the nitrogenous organic matters in bad air are the really injurious ones, and that an increase in the two forms of ammonia is sufficient to condemn the air yielding it. Mr. Remsen, however, is inclined to think that the question whether the amounts of ammonia and albuminoid ammonia yielded by air can be regarded as reliable measures of its impurities is still an open one. The main results established by these investigations he sets down as follows:

1. The nitrogenous matter of the air may be thoroughly collected by means of the pumice stone absorber described in this report.

2. The total amounts of ammonia found in experiments performed at the same time with the same specimens of air agree fairly well with one another; so much so as to warrant the use of the method for the examination of the air.

3. When free and albuminoid ammonia are determined, the results obtained do not always agree very closely, but still the agreement is sufficient to enable the experimenter to detect such variations as are likely to occur between pure and impure air.

4. Air contaminated by being drawn through water containing decaying meat does not yield more than the usual quantity of albuminoid ammonia.

5. Air contaminated by being drawn over comparatively dry decaying organic matter yields more than the usual quantity of albuminoid ammonia.

6. Air contaminated by respiration yields more than the usual quantity of albuminoid ammonia.

7. It is necessary in judging of the purity of air to take all the facts known in regard to it into consideration. The simple determination of any one constituent can never be a sufficient basis for the formation of a competent judgment.

8. It would be useless to have examinations of air made by any but the most careful workers. It would be time thrown away to have such analyses made by the average practical chemist.

Among the questions left unanswered an important one is this: Is the air which has been deprived of its nitrogenous matter also deprived of its injurious constituents? Another is this: Does the amount of organic matter in the air vary with different conditions of the air, as, for instance, with its hygrometric state?

The first question must be answered by the physiologist, not by the chemist. The effect of the air on fermentable liquids must be studied, and its effect when breathed by animals. The second question can be answered only by long continued systematic series of examinations of the air, such as are now being made at Glasgow, at Montsouris, and at some places in Germany.

THE PHILADELPHIA SHEEP AND WOOL SHOW.

An international sheep and wool show was held in Philadelphia during the latter part of September, under the auspices of the Pennsylvania State Agricultural Society. A large and interesting collection of sheep, sheep dogs, wool, and woolen manufactures was exhibited. The show of machinery was small. The chief object of the exhibition was to bring together breeders and manufacturers to promote a better understanding of their mutual interests, and to give a greater impetus to the rearing of sheep, in order that the country may grow at home the fifty million pounds of wool now annually imported by our manufacturers.

In furtherance of this object an international convention was held, beginning September 22, to discuss questions relating to sheep breeding, wool growing, and wool manufacturing. The first paper presented was by Mr. A. M. Garland, President of the National Wool Growers' Association, in relation to the breeding of sheep, and the influence of food and climate upon the quality of wool. The work of the Department of Agriculture in collecting and disseminating information with regard to flock products and the demand for them, was described by Commissioner De Luc, and discussed by a number of gentlemen prominently interested in this industry.

At an adjourned meeting the next day the Secretary of the National Wool Growers' Association and President of the New York Association read a paper on the relative advantages of our sheep-breeding States, and the breeds best adapted to them. Mr. John L. Hayes, of the Wool Manufacturers' Association, addressed the convention on the subject of the grades of wool which this country must produce in order to supply the demands of our looms, and how best to produce them.

Among the other subjects discussed were methods of shearing and handling sheep and of packing and grading wool for the market; increasing the production of the mountain lands of the Atlantic States by the systematic extension of sheep husbandry; benefits resulting from the introduction of pure blood into our native flocks; breeds capable of yielding from a given acreage the most profitable returns in mutton and wool taken jointly; management of sheep in summer and winter—of lambs most profitably for market; national registration of herds; recent inventions in wool manufacture and their relative importance; recent discoveries and inventions in the production of dyes and the art of dyeing—their relative importance.

A popular part of the show was the competitive exhibition of the working qualities of sheep dogs.

ORIGIN OF THE MERINO SHEEP.

As the ancient Greeks had no cotton nor silk and very little linen, and as sheep's wool was the principal texture from which their clothes were made, they took peculiar care to cultivate with especial care such breeds of sheep as produced very fine wool. Such breeds were those of the Greek city of Tarentum, situated on the Tarentine Gulf. In order to improve the fine quality of the wool still more, the sheep were covered with clothes in cold weather, as it was found by experience that exposure to cold made the wool coarser. Thus clothing these sheep from generation to generation resulted in a very delicate breed with exceedingly fine wool, according to the law established by Darwin in regard to selection and adaptation to exterior conditions.

This product of Greek industry was transmitted by them to the Romans, whose great agricultural author, Columella, states that his uncle in Spain crossed the fine Tarentine sheep with rams imported from Africa, and obtained a stronger breed, combining the whiteness of fleece of the father with the fineness of the fleece of the mother, and having obtained such results the race was perpetuated. The absence of other fine textures made these Spanish sheep so valuable that in the beginning of our era they were sold in Rome for $1,000 in gold a head, an enormous price for those times, when money had much more value than now.

When the Barbarians invaded Italy these sheep were all exterminated, while the greater portion of the Roman posses-

sions were laid waste. But in the less accessible mountains of Spain the Moors preserved the breed, and it is to them that modern Spain owes the merino sheep, which are the direct descendants of this cross breed of the Greek and African ancestors referred to. It is a valuable inheritance, too, which that country owes to the combined Greek, Roman, and Moorish civilization, and of which our California woolgrowers also earn the advantages, by the prosperity of this breed of sheep, which was there a few years ago.

PROGRESS OF COTTON SEED OIL MANUFACTURE.

The industries of the South have, since the close of our civil war, been extending in different directions, while some peculiar branches have attained a degree of importance never dreamed of in the days of slavery. One of these is the manufacture of the oil of cotton seed and the art of refining the same, by which it is made as sweet as olive oil, and not only used as such in the United States, but it is now largely exported to Italy to compete with the native olive oil, which is a staple article. It is there used for adulterating the native article, and then it is exported again as genuine olive oil. This has already become a serious matter, as of the six million gallons of cotton seed oil which were exported from the United States during the last year, the greater portion went to Italy. The Italian Government, therefore, in order to check this adulteration, has imposed a heavy duty upon the importation of cotton seed oil from the United States. The exportation, which in 1877 and 1878 was about one and a half million gallons per year, reached in 1879 nearly six millions, and this will be surpassed in 1880. Our home consumption of the article is over two million gallons per year.

Mississippi and Louisiana have each 9 cotton oil mills; Tennessee, 8; Texas, 6; Arkansas, 4; and Missouri, Alabama, and Georgia, 2 each; together, 42. At present 410,000 tons of the seed are now pressed, yielding 35 gallons of oil and 750 pounds of oil cake to the ton of seed. This oil cake has admirable fattening qualities, and is largely used for cattle.

Progress of the Brush Electric Light.

The Brush Electric Light Company, of New York, have opened offices at 860 Broadway, and the officers expect that before the end of October a large number of lights will be in operation in the vicinity of Madison and Union squares. Negotiations for a building near Madison square, in which to place the engines and other machinery, are about completed. In the district to be illuminated there are many public buildings, restaurants, and stores. It is said that no attempt has been made to subdivide the light for use in private dwellings, but for lighting large areas the Brush system is entirely successful.

The Brush Company of New York is distinct from the general company having its headquarters in Cleveland. The New York company was recently incorporated, and holds the privilege of using the Brush light on Manhattan Island only.

The officers of the new company are: President, W. L. Strong; Vice President, A. D. Juilliard; Secretary and Treasurer, A. A. Hayes, Jr.; General Manager, C. M. Rowley.

Postponement of the Prize.

Mr. Edward Lee Brown, Chicago, Ill., President of the American Humane Association, writes us that the time for receiving models and plans in competition for the prize of five thousand dollars offered by the Association for the most approved cattle car, has been extended until January 1, 1881.

THE UNICORN.

The unicorn is generally regarded as belonging more to the realm of fancy than of fact, yet according to M. A. T. de Rochebrune, of the French Academy of Sciences, a race of animals exists in Africa which resemble the fabulous unicorn more than any other living beast does. It is true that this animal has two other horns like those of a cow, but since there are "mooly" cows having no side horns, there may be similarly unfinished animals among these beasts described by M. De Rochebrune, in which case they would present all the characteristics of the distinguished unicorn who is popularly supposed to be fighting the British lion for the possession of the crown. M. De Rochebrune says: Naturalists and travelers, for some unknown reason, have kept the most absolute silence as to a race of domestic cattle belonging to Senegambia. Belonging, like the greater part of its African relations, to the group of great zebus (*Bos indicus*, Auct.), it appears to be indigenous to the high plateaus of the Fouta-Djallon, whence the Pouls, a pastoral people, have scattered the animals for commercial purposes along the whole coast, from Cape White to the Point de Galle. The Negroes and Moors use them for beasts of burden under the name of carrier cattle. An eminently exceptional characteristic distinguishes them from other races; this characteristic consists of a genuine horn in the nasal region, identical in its nature and even in its mode of development with the frontal horns. Belonging to the females as well as the males, this horn, sometimes conical but more frequently developed in the form of a four-sided truncated pyramid, reaches a height of 2¼ to 2¾ inches, a width of 2 inches, and a thickness of 1½ inches; its faces are furrowed with vertical furrows and crossed by stratified horizontal ridges from base to summit. Out of a herd of one hundred of these animals about sixty will have this well-defined nasal horn, while the remaining forty will not have it, but will have a nasal hollow in the roof of the mouth, covered with a horny plate, thin and rough. There are some other anatomical peculiarities of this animal, but the chief one is the nasal horn.

INSECTICIDES FOR THE PROTECTION OF COTTON.

BY PROF. C. V. RILEY.

In some remarks at the recent meeting of the A. A. A. S., I gave an account of some of the more recent practical results of the investigation now being carried on by the United States Entomological Commission, to ascertain the best means of controlling the insects affecting the cotton plant. I herewith give you the substance of that portion referring to insecticides.

The experience of the year has so far given us nothing superior to the substances previously tested. We have over five tons of extracts and decoctions of various native plants centered at Selina, made either by Prof. R. W. Jones, of the University of Mississippi, or by Mr. James Roane, agents of the commission. But two or three so far give any promise, and these not much. Yeast ferment or beer mash, which Mr. Hagen so strongly recommended, has proved entirely useless. Of the various arsenical poisons, Paris green still proves the best, so far as efficacy and harmlessness to the plant are concerned, but the use of this and of different preparations of white arsenic is to-day so well understood that they need no further mention.

LONDON PURPLE.

Of this arsenical refuse, which I introduced for this purpose a year ago with a good deal of hope as a cheap substitute for Paris green, it will be well, however, to say a few words.

The testimony in regard to it is very generally favorable the present year, as I anticipated would be the case from the experiments we made in 1879. But some reports are less favorable, and such mostly come from parties who have not understood how properly to mix and use it. Pound for pound it should be made to go twice as far as Paris green; *i. e.*, a pound of the purple is sufficient to eighty, or even one hundred gallons of water, and if used dry, should be in proportion of one to forty parts of the diluent.

It should be borne in mind that great care is necessary in mixing it in water to prevent its forming lumps, and that it acts more slowly than Paris green. To this last fact is due most of the unfavorable experience and judgment. If a rain follow too soon after an application, the purple kills comparatively few worms. Its good effects are fully seen only under favorable circumstances on the second or third day, while the green shows its good effects a few hours after application, and particularly the day following. In the early use of the green the same diversified experience was had, and from defective methods or adulterated material unfavorable results were quite frequent. One source of failure with both these materials in liquid is the lack of provision to keep them stirred up and well suspended; another, in not bearing in mind that the poison has greater specific gravity than the water in which it is carried, so that in poisoning many rows at a time, the finer spray falls on the furthermost rows with little or no poison.

London purple is exceedingly fine and sifts through the slightest crevice. This is an advantage to the planter who uses it on his cotton, but necessitates great care in shipping. The manufacturers have shipped it for the most part in barrels, which have permitted it to leak and stain other goods, as well as the vehicles of transport, thus doing more or less injury and prejudicing freight agents against it. This defect should be remedied.

Experience seems to indicate that it is less dangerous to use than Paris green. We know of two negroes who stole some flour in which it had been mixed in the ordinary proportion for use on cotton, and made biscuits thereof. Both were made sick, but neither seriously, and Prof. Barnard found that the steward on one of the Mississippi steamboats (the decks of which get quite purple from carrying it) has made regular use of the wastage, so easily obtained on every hand, for coloring his pastry and ice cream. That no ill results have followed is no reason for perpetuating the practice. Some of the unfavorable experience with this purple, I am constrained to believe, has resulted from adulteration.

PYRETHRUM.

This powder, of which, since last year's experiments, I have had great hopes, fully warrants them. No other vegetable substance approaches it. Last year, while it was found by Prof. Hilgard, of California, that an alcoholic extract of any part of the plant possessed the insecticide property, I had serious doubts whether it could ever be successfully used in the cotton field because of its cost. The simple powder mixed with flour as a diluent could then be made to go over more ground than the alcoholic extract. The present year we have found that an ordinary fluid extract, made after the usual formula of the Pharmacopœia, will go much farther, and that the extract from a pound kills all young worms when diluted in one hundred and twenty gallons of water. Nay, more, one of the most important discoveries is that it acts equally well or even better when the powder is simply mixed with water, and even one pound to one hundred and fifty gallons is effective, and one pound to two hundred gallons will cause the destruction of most young worms. Its action is really marvelous, but as it kills by contact, its effects are not lasting, as in the case of arsenical poisons, which act through the stomach. It produces convulsions and paralysis, so that all young worms it comes in contact with soon writhe to the ground, from which they rarely recover, even if the pyrethrum fails in the end to kill, for once on the ground and enfeebled, and a host of enemies are always ready to finish the work begun by the powder. This insecticide acts quite differently on different insects, but Aletia is one of the most susceptible to it.

I have not a doubt but that when it is once produced in this country so that the cost of the powder will be nominal, it will be extensively employed by planters, and to this end I have taken steps to have it introduced and cultivated. Its harmlessness to man, the small quantity necessary, and the fact that it may be grown by the planter himself, will offset the greater permanency of the arsenical powders.

OILS.

Nothing is more deadly to the insect in all stages than kerosene, or oils of any kind, and they are the only substances with which we may hope to destroy the eggs. In this connection the difficulty of diluting them, from the fact that they do not mix well with water, has been solved by first combining them with either fresh or spoiled milk to form an emulsion, which is easily effected; while this in turn, like milk alone, may be diluted to any extent so that particles of oil will be held homogeneously in suspension.

Thus the question of applying oils in any desired dilution is settled, and something practicable from them may be looked for.

Fraudulent "American" Cottons.

During a recent tour through Lower Egypt an American correspondent was astonished to find at Rosetta, Damanhour, Zagazig, and especially at the great fair at Tantah, a great quantity of cotton goods offered for sale purporting to be of American manufacture. These goods consisted of a wretched flimsy fabric, filled up with "sizing." A large portion of them bore the word "Mexican" in large English letters and underneath the word "American" in large Arabic letters. The traveler found on consulting the official report of the Director of the Egyptian Statistical Bureau, M. Amici Bey, that no American cotton goods have been entered at the regular Egyptian custom house during the past five years. A small quantity of American cotton goods have entered Egypt by way of Smyrna, where the greater part of the duty was paid; but all such goods were found upon inquiry to have been of uniform excellent quality. The presence of the fraudulent "American" goods is explainable only on the theory that the English manufacturers, who now monopolize the Egyptian market, have found a new way of "spoiling the Egyptian," by palming off upon them their "cheapened" goods as American, and thus momentarily avoiding the consequences of their cheating in the fabric and at the same time doing untold harm to American manufacturers.

Spurious Indian Implements.

A Western journal announces the finding of a fine specimen of the discoidal stone, a kind of stone implement rarely found, and deserving notice on account of the growing interest in American antiquities. The name has been given to this form of stone for reason of its double convex shape. It is said to be made of quartz, very smooth, and it is remarked that its manufacture without the use of metallic tools must have cost the ancient mound builder who made it the labor of many months. Its use cannot be accounted for. We are inclined to believe of such stones what the State Geologist of Indiana, Prof. Cox, said of a similar but elongated specimen exhibited at the late meeting of the American Association for the Advancement of Science, in Boston, found in the Wyandotte Cave, and pretended to have been some kind of tool of the early cave dwellers. Prof. Cox considered it simply as a natural production, a piece of water-worn rock, made smooth by continual rollings; the marks of wear upon its ends he declared to be recent, and formed by collectors of mineral specimens who found it a handy substitute for a hammer to knock off pieces of rock. He said that the tendency to consider every peculiarly shaped stone as an Indian implement is running wild, that every splinter of quartz is considered an arrow-head, every small bowlder an Indian hammer or ax, etc., and warned collectors only to trust to undoubted marks of human workmanship.

Diamond Cutting in New York.

Among the curious and interesting industrial facts brought to light during the census inquiries not the least is the fact that the recently introduced art of diamond cutting has been so admirably developed here that diamonds cut in Amsterdam are now sent to this city for recutting. Hitherto Amsterdam has monopolized the work of diamond cutting; and the aim there has been to remove in cutting the least possible weight of the gem. The American plan is to cut mathematically, according to recognized laws of light, so as to secure the utmost brilliancy for the finished stone. The greater loss in weight, as compared with the Amsterdam cutting, is thus more than made good by the superior brilliancy of the product. From the inquiries made by chief special census agent, Chas. E. Hill, it appears that the average increase of value given to diamonds by the New York cutting is $5,000 for each person employed for twelve months; also, that our dealers are receiving the best Amsterdam-cut gems from abroad to be recut here and returned.

The Stevens Battery Sold.

The costly experiment in naval architecture, known as the Stevens battery, was sold at auction, by order of the New Jersey Court of Chancery, September 29. Something like $2,000,000 have been spent on the undertaking. The hull of the vessel, as far as completed, with the engines and boilers on board, a locomotive boiler and Worthington pump, and a quantity of rope and trestle work, and shed beneath which the battery was housed, brought only $55,000. The buyer was Mr. William E. Laimbeer, of this city. The old iron and articles in the machine shop, blacksmith shop, shed, storeroom, and yard, brought $7,790, making the entire proceeds of the sale $62,790. Two years ago the estate refused $125,000 for the battery.

MAXIM'S NEW FOCUSING ELECTRIC LAMP.

Very nearly all focusing electric lamps have until recently been imported from England and France. The Duboscq was the first electric lamp ever made and regularly placed in the market for sale. It was originally intended by its inventor for use in the theaters of the French capital.

In the Duboscq lamp there are two opposing forces, one for pushing the carbons together, and one for drawing them apart. Each is provided with a separate system of clockwork, and a vibrating detent is balanced between the two in such a manner that it unlocks one system at the same moment that it locks the other. If the current is too strong from a too short voltaic arc, a magnet pulls the detent away from the system that pushes the carbons together, and at the same time unlocks the system that pulls them apart; while if they are too far apart a contra result takes place.

The next electric lamp to meet with popularity was the "Serrin," in which the carbons were fed together by the weight of the positive carrier, their position being nicely regulated by a single system of clockwork. This lamp had quite an extensive sale prior to the introduction of the celebrated Jablochkoff candle into France.

The Siemens lamp may be described as one with a small electric motor inside its case, so arranged that it moves the carbon in either direction, up or down, as may be required.

All the above-named lamps are beautifully made and operate very well in laboratory experiments. For rough usage in the hands of the unskilled they are liable to become disarranged and out of order.

Hiram S. Maxim, M.E., has lately produced a new focusing lamp, of which we herewith give illustrations. It is especially intended for use at sea in connection with his marine projector. This lamp is very strongly and substantially made, all the parts being of considerable weight, with no delicate points requiring fine adjustment.

Fig. 1 shows a side elevation of this lamp. In Fig. 2, which shows the internal mechanism, A is a tube in which the positive carrier operates, and B is the tube of the negative carrier. On the positive carrier there is a rack, C, which meshes into the train of gears. D is a pulley on the lower extremity of the negative carrier. E is the coil of an axial magnet. F is a stop for arresting the movement of the gears when extinguishing the light. G is an adjusting screw which determines the length of the voltaic arc.

The operation of this lamp is as follows: The positive carrier being drawn upward to its fullest extent and carbons placed in the holders, the weight of the positive carrier sets the train of gears in motion. As the positive carbon descends it winds up the cord and draws the pulley, D, upward. When the two carbon points touch the circuit is completed, the current passes, the helix is excited and draws the coil, E, downward, which, being attached to a detent, locks the gears which prevent any further advance of the positive carbon, and at the same time establishes the voltaic arc by the downward movement of one end of the cord which holds the negative carbon. As the carbons become consumed and the arc becomes lengthened, the degree of excitement in the helix is correspondingly lessened. The spring draws the coil upward until the detent unlocks the gears, when the carbons slowly approach each other until the arc is reduced to a proper length, when the current is brought back to its normal strength, the coil drawn upward, and the gears again locked.

All the parts being nicely pivoted, very little change in the electromotive force is required to lock or unlock the gears. In places where a special engine operates the dynamo machine it is desirable to use as small an engine as possible. Space can thereby be economized, and the first cost of the apparatus for operating the machine, as well as the steam used, demand that the machine should run as lightly as possible.

When the carbons in a lamp run together or approach very near to each other, much more power is required than when a proper distance is maintained between them. With this lamp, however, very little margin has to be allowed, as the construction of it is such that the carbons can draw apart to the desired distance at any time.

Tests have shown that machines of all makers run lighter on this lamp than on any other, and with much less fluctuation of power.

Any further information may be obtained from the United States Electric Lighting Company, 120 Broadway, New York

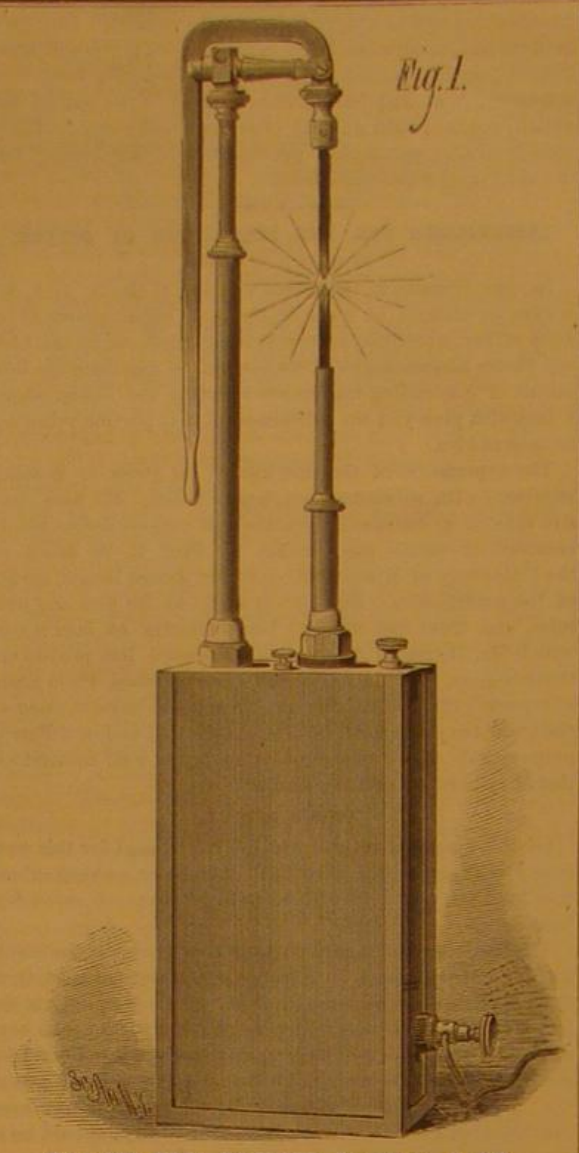


Fig. 1.

MAXIM'S NEW FOCUSING ELECTRIC LAMP.

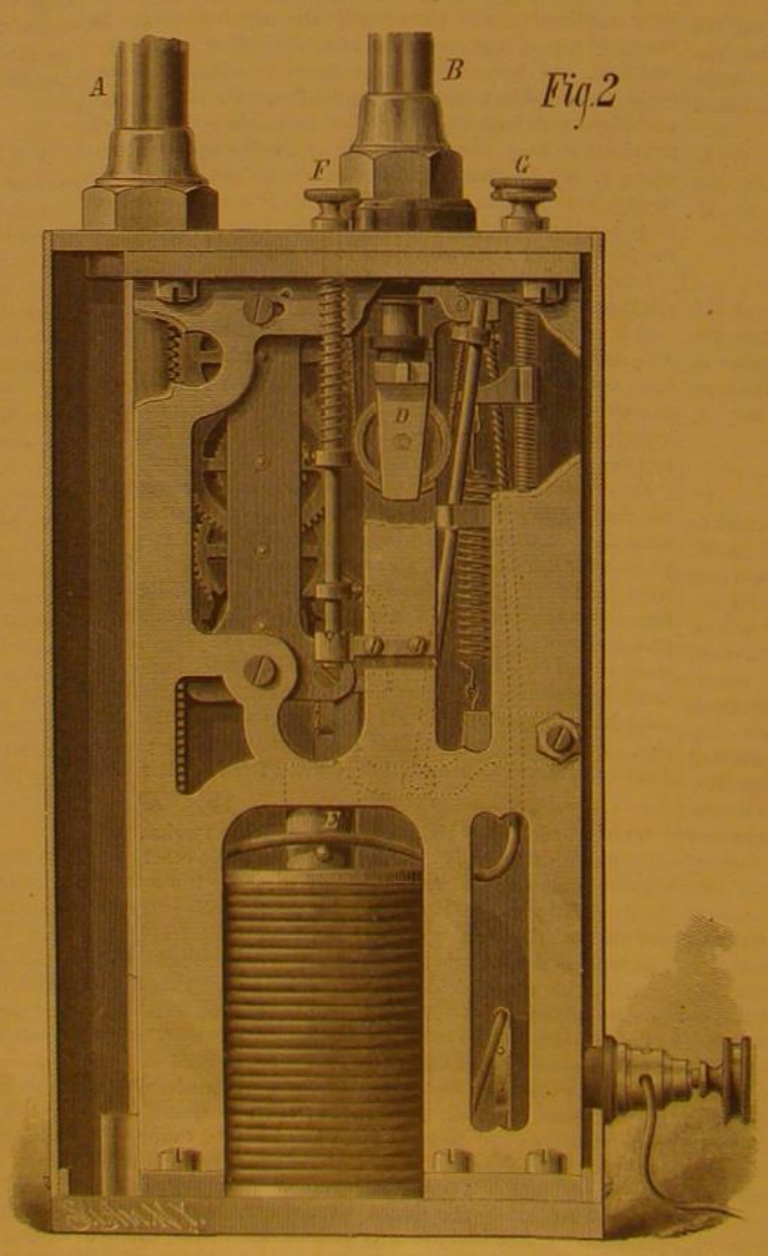


Fig. 2

MOVEMENT OF MAXIM'S LAMP.

ENGINEER AND INVENTOR.

Among the recent deaths in this city was that of Col. Eugene H. Angamar, of New Orleans, La. He was a highly educated engineer, and before the war one of the most successful sugar planters of St. Landry Parish. He devised and practically demonstrated during the year 1859 a method of closing crevasses, which quickly checked those terrible overflows that so often inundated the finest portion of his State. It is of record that through the efficiency of his apparatus—tested on our coast before and after the war—many dangerous crevasses were closed in a remarkably expeditious manner. He invented several methods of exploding torpedoes and otherwise proving his engineering skill. He filled the office of engineer of the State of Louisiana, having special charge of the levee system and the connection with the Mississippi of some of the tributaries of the great river. He was later in charge of the method of applying compressed air to the uses of street cars in New Orleans. Subsequently he devised a method of applying steam to surface and elevated city railroads, which, while retaining all the especial power of steam, divests it of the objections to use in city streets. By charging the boiler at the station with highly heated water and his furnace with a few shovels of live coals, his car makes a run of twenty miles without attention to either the fire or water supply during the trip. Obviating all smoke, gas, or exhaust of steam while in service on the most crowded streets, from the large volume of water used, nearly three times that of other boilers, rendering the boiler entirely safe, his method was successfully demonstrated recently by a continuous run of three months on the Third Avenue horse railroad of this city.

THE Extension Water Gauge Company, whose apparatus we recently illustrated, have their headquarters at Cheshire, New Haven county, Conn. Mr. C. N. Marcellus, 91 Liberty street, New York, is agent. The company have no office in New Haven, as erroneously stated in the article referred to.

RECENT INVENTIONS.

Mr. John Collins, of Brooklyn, N. Y., has patented apparatus for generating gas for mineral waters. This is an improvement in that class of carbonic acid gas generators in which the discharge of acid into the chamber containing lime or other carbonate is regulated automatically by the variation in the pressure of gas, which acts upon a piston that, in turn, tilts a pivoted lever, and thereby opens a valve that controls the escape of acid from its tank or holder.

Mr. John Collins, of Brooklyn, N. Y., has patented a wagon for mineral water and other gaseous liquid fountains, so constructed that the fountains can be readily placed in and removed from the wagon, and will be held securely in place while being carried.

An improvement in gates has been patented by Mr. Robert M. Grier, of O'Fallon, Mo. The objects of this invention are, first, to prevent the trouble arising from sagging of gate posts; second, to provide for widening the gate entrance when an unusual width is required; and, third, to furnish a gate of durable construction and requiring but a small quantity of lumber for its manufacture.

Mr. Henry W. Fleming, of Denver, Col., has patented a drill which will bring out a solid core of rock from any desired depth at which it is practicable to drill or bore.

An improved measuring pump, designed to draw out all the fluid from a barrel, and to correctly measure molasses, oil, or any other liquid, and to dispense with oil tanks, measures, funnels, and tapping devices, has been patented by Mr. Fradelshon Harris, of Rockport, Ill.

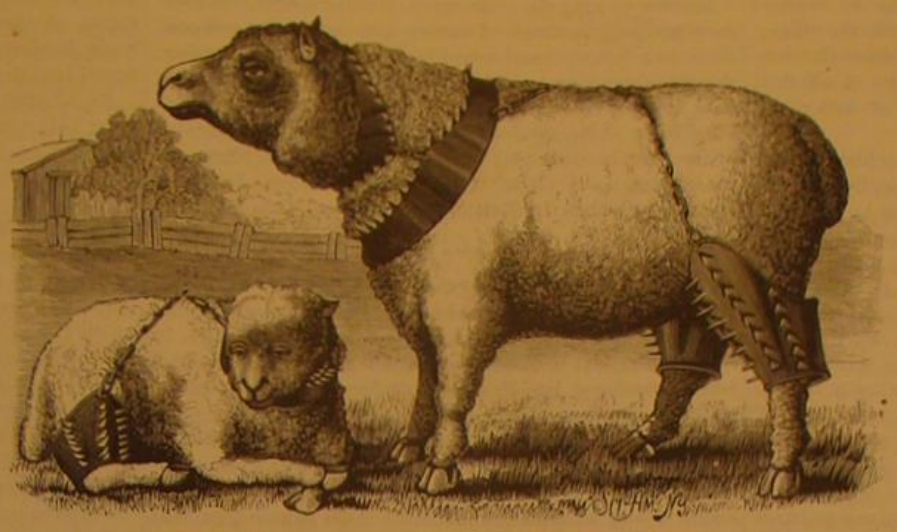
An improvement in the class of pendulums designed for use in connection with clocks requiring compensating pendulum has been patented by John W. Hile, of Leavenworth, Kan. This improvement consists in the construction and arrangement of parts, whereby the bob or weight is adjusted up or down automatically to compensate for changes in the length or extension of the pendulum due to changes in temperature of the surrounding air or adjacent surfaces or objects.

Mr. Alden B. Richardson, of Dover, Del., has patented an improved device for soldering tin cans, which is an improvement on that form of device shown in Patent No. 74,290, in which a copper block is notched to receive the edge of the can, and this notch is filled with solder which is kept in a melted condition by a flame beneath, while the can is soldered by singly turning its edge in the notch of the copper block.

Mr. Israel V. Ketcham, of Brooklyn, N. Y., has patented an improvement in milk pails used by dealers for delivering milk in small quantities to consumers. The object of the invention is to furnish a self-measuring pail from which a regulated quantity of fluid shall run at each inversion of the pail.

NEW SHEEP PROTECTOR.

The engraving shows a curious device intended to protect sheep from the ravages of dogs and wolves; but whether sheep would be safer with a machine of this sort than with the dogs and wolves is a question which we leave to the reader to decide. This device was recently patented, and is thus described by the inventor: The invention consists of two collars for the neck of the sheep, which are provided with sharp pointed projections, and are coupled together by two or more links. To the upper side of the rear collar is attached a chain, strap, or strip of metal or other material, which passes along the back of the sheep and branches off toward the thighs of the hind legs, and is attached to a shield on each hind leg, which shields conform to the parts of the hind legs above the knee, the shields being perforated and furnished with outward projecting points. It has been observed that dogs often attack sheep at the points covered by the shields, hence the employment of them in combination with the collars. The projections or points on the collars and shields operate to lacerate the mouth of the dog in case it should attack the sheep, the point of attack, as a rule, being the parts covered by the collars and shields.



NOVEL SHEEP PROTECTOR.

Spontaneous Combustion of Charcoal.

Among the substances subject to spontaneous combustion, according to the *Fireman's Journal*, pulverized charcoal is said to be one of the most remarkable. Incidental to this phenomenon a story is told that a load of charcoal was delivered in an outhouse of a clergyman in Leipsic, and showed no signs of burning until the door by accident was left open, when the wind blew sprinklings of snow on the charcoal. The rapid absorption of oxygen from the melting snow caused the charcoal to ignite, and as the day was windy the whole range of buildings was burned to ashes. In this connection a fruitful and unsuspected source of fire suggests itself to those of our American housekeepers who burn wood as fuel, and who store the ashes in boxes or barrels. The accidental disturbing of such ashes, even after years, will cause them to ignite, provided the air is damp or foggy. The phosphuret of potash from decayed wood renders wood ashes highly inflammable, and mysterious cellar fires in the rural districts are, no doubt, in some cases, caused by this form of spontaneous combustion.

MACHINE FOR ORNAMENTING METAL SURFACES.

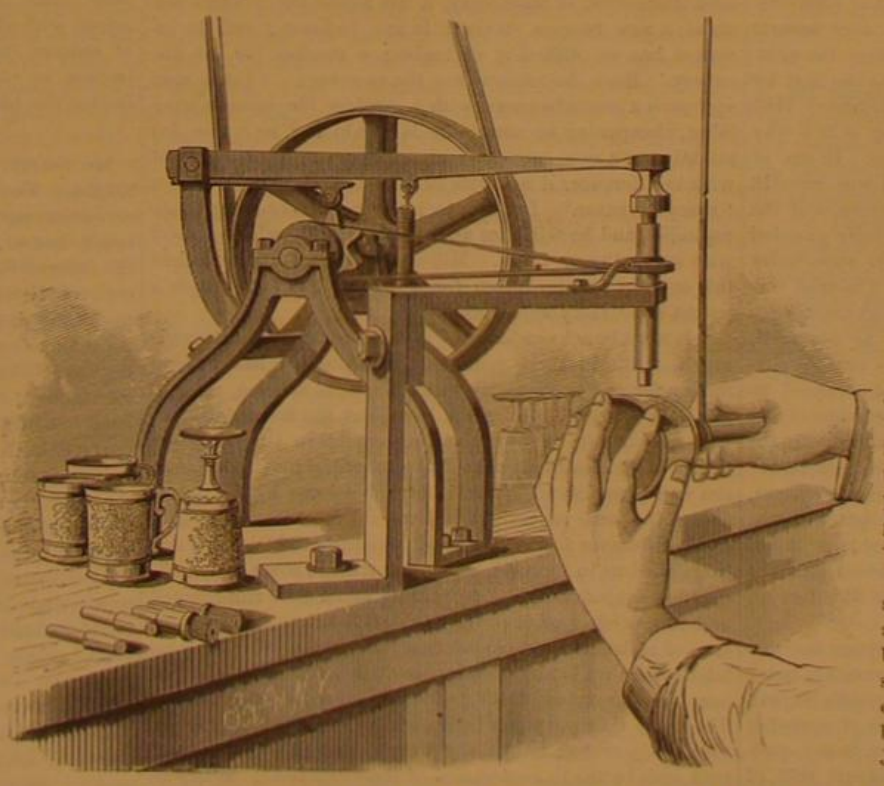
The machine shown in the engraving produces all kinds of chased or matted surfaces, but is more particularly designed for producing a peculiar surface called the "snow flake" finish. The tool used in the machine is of novel form, and has a combined rotary and impacting movement.

A standard rising from the base of the machine supports an arm, which carries at its outer end a sleeve containing a vertical mandrel, which is supported by a spiral spring in the lower part of the sleeve. This mandrel receives its motion through a quarter twist belt from a pulley on the driving shaft, and carries a chasing tool whose face is composed of fine parallel ridges and center punch indentations.

Above the mandrel there is a hammer, which is alternately lifted and allowed to fall by the action of the cam on the driving shaft. The hammer is drawn downward by a spring which insures a positive and elastic blow.

The tool intermittingly advances against the surface to be finished with an impact derived from the blow of the hammer, having meanwhile a rotary motion about its axis from the action of the belt. The sudden impact of the tool against the surface to be finished causes a set of parallel indentations on the metal surface, which appear in patches, with the parallel lines of one patch appearing at a different angle to those of the next. As the time of contact between the tool and surface to be finished is only momentary, the parallel lines are not obliterated by the rotary action, the latter serving only to place the patches in different angular relation on the metal surface.

This invention was recently patented by Messrs. John Hewitson and Elijah Tolman, of Taunton, Mass.



MACHINE FOR ORNAMENTING METAL SURFACES.

How to Fire Steam Boilers.

Mr. J. F. Tallant, in the *Milling World*, tells its amateur engineer readers how to set and fire steam boilers.

In placing a steam boiler in a furnace, says Mr. Tallant, it is usual to employ grate bars, even for coal, about four feet long, the same length that was necessary where wood fuel was used. The rear end of the bars should be at least the thickness of a brick, or upwards of two inches, lower than the front. The boiler should also be placed two inches ower at the rear than at the front, and the bridge wall should come within three inches of the boiler, if the draught is good.

The best grate bars now used are of a zigzag shape on the top, so closely placed that coal lumps upwards of one-eighth of an inch through cannot drop between. Three stoking pokers should be used—one a plain straight poker, another with claws, and another like a hoe. In firing, the coal should be so distributed as to be totally consumed without smoke, if possible. The more smoke the worse the firing.

After steam is raised and work is fully begun, in replenishing the fire, the glowing coals should be pushed back with the iron hoe toward the bridge wall, and if any clinker is seen, remove with the claws. The fresh coal should be well scattered over the front, so that the smoke will pass over the red hot coals and be consumed by them. Avoid making piles of coal on the bars. It is often beneficial to have a very small steam pipe open into the furnace, to give a spray of steam to the flaming mass. Water being composed of two most combustible ingredients, oxygen and hydrogen gases, when the steam is decomposed the heat becomes most intense. This pipe should be regulated by a cock, and its use requires considerable skill, as an oversupply of steam will quench the fire instead of increasing it.

To permit a boiler to run too full of water is as wasteful of fuel as it would be dangerous to have too little. Of the two extremes, the latter is most common, generally through carelessness. To fire efficiently yet economically is a very skillful, intelligent operation, and the man who can do it and actually does it for his employers cannot be too highly esteemed by them, or be too well paid. Brains and vigilance as well as main strength and muscle must be used continually.

The World's Wool Clip.

The wool clip of the world has increased five times since 1830, when it was about 320,000,000 pounds in weight. In 1878—the latest year for which there are complete figures—Europe produced 740,000,000, River Plate 240,000,000, United States 208,000,000, Australia 350,000,000, and South Africa 48,000,000 pounds, making a total of 1,586,000,000 pounds. Great Britain and France consume each about the same quantity of wool—380,000,000 pounds a year. Germany consumes about 165,000,000 pounds; United States 250,000,000 pounds; and Russia, Austria, and other countries, 400,000,000 pounds.

ENGINEERING INVENTIONS.

Messrs. Peter Vanbriggle, Lewis Vanbriggle, and Henry Vanbriggle, of Kempton, Ind., have patented an improved rotary engine. The invention consists in regulating the supply of steam to the engine by forcing air from the steam cylinder into a connected air chamber to operate a cut-off valve therein, increased speed of the engine causing a corresponding reduction in the supply of steam.

Mr. William C. Perry, of Brattleborough, Vt., has patented an improvement in automatic couplers, which consists of two hooked coupling bars pivoted in suitable recesses in each drawhead and resting on springs, of spring actuated catches for holding the hooked heads of the coupling bars, and of recesses within said drawheads to admit of coupling with the old style of link and pin.

Mr. Gordon W. Hall, of Havana, N. Y., has patented a steam boiler having central magazines or reservoirs for fuel. The object of the invention is to insure more perfect combustion and to superheat the steam. The invention consists in a vertical boiler provided with a steam dome containing tubes placed above a combustion chamber at the upper end of the boiler, the tubes of the steam dome being fitted with removable caps at the upper end. The caps give access to the boiler tubes as required, and also cause return of the draught to the smoke box around the ash pit.

An improved car coupling has been patented by Mr. Robert E. Pogue, of Quincy, Ky. This invention relates to that class of car couplings which are known as "self-acting couplers;" and it consists in a novel combination and arrangement of a coupler, a cap, and a series of levers, whereby provision is made for coupling the cars automatically and for uncoupling them without the necessity for going between the cars.

Messrs. Samuel Barrow, David Barrow, and Jacob Barrow, of Indianapolis, Ind., have patented an improvement in steam boilers, which consists in a heating box combined with a tubular flue boiler in a manner to form one side of a chamber into which the flues discharge. This heating box is hinged to the main boiler, and the inlet and outlet pipes from the box are provided with separable joints, so that the box may be swung out to give access to the flues. The box is also provided with a filtering chamber between its inlet and outlet for filtering the feed water.

Messrs. Samuel Barrow, David Barrow, and Jacob Barrow, of Indianapolis, Ind., have patented an improvement in rotary engines, water motors, or pumps, wherein a wheel is fitted eccentrically in an elliptically shaped chamber or steam and water way, and fitted with two pistons, which are projected from the periphery of the wheel and travel in an elliptical path.

An improvement in the class of steam-generating apparatus for use in cooking feed for live stock, has been patented by Messrs. Mortimer B. Mills and Charles B. Rice, of Chicago, Ill. The apparatus is compact in form, adapted for heating the water quickly, and provided with means for automatically regulating the supply of water.

An improved construction of boat designed more particularly for use on canals, shallow rivers, etc., has been patented by Mr. John O. Smith, of Savannah, Ga. It is formed with a view to the production of the least possible waves in the water, so as to avoid the washing of the bank. It is an improvement in that general class of boats which are propelled by an endless chain revolving in a longitudinal channel around two sprocket wheels.

An improvement in the class of clutch and spring mechanism which is so constructed and attached to a car axle that the spring may be wound up when it is desired to retard the speed of the car, and allowed to unwind or expand when it is desired to start the car, has been patented by Mr. T. Judson Langston, of Johnstons, S. C.

An improved reversing and cut-off mechanism for steam engines has been patented by Mr. William L. Miller, of Cleveland, Ohio. The object of this invention is to dispense with the guides, crosshead, and link required in reversing mechanism of usual character, and to move the valves for cutting off and reversing by the use of a single eccentric.

Honoring an Old Inventor.

The ceremony of unveiling a bronze statue in honor of the seventeenth century inventor and precursor of Watt in applying steam as a motive power, Denis Papin, took place in the little town of Blois, France, August 29. Among the prominent speakers was M. De Lesseps, who gave an interesting account of the life and discoveries of Papin. Like so many early inventors, Papin suffered cruel persecution at the hands of the people whose descendants now unite to do him honor.

AMERICAN INDUSTRIES.

[*Continued from first page.*]

and keys itself into it in the same way as mortar is put on and holds itself to the laths in finishing the interior of a house.

The application of this plastic non-conductor was first made directly to the surfaces of boilers, tubes, etc., and this method is still followed to a great extent where the tubes are small, or only limited surfaces are to be covered, and the expansion and contraction from differing temperatures will not be too great. The covering after it is put on has not a metallic hardness and firmness, so that its elasticity is sufficient for purposes of this kind, while it may also be colored, grained, varnished, and finished, so as to make an exposed steam pipe in a room accord in appearance with the character of the place, when this is desirable. It is also sufficiently oleaginous to prevent the oxidation of surfaces to which it is applied, and thus acts as a preserver of boiler and piping.

The "air space" covering, the patent for which became the property of the company in 1875, undoubtedly affords a better non-conducting covering than that made by the application of the plastic material directly to the surfaces to be protected. In this way a dead air chamber is made, so that the air surrounding the heated surfaces must be of an equal temperature with them, and any amount of expansion and contraction cannot affect the durability of the covering. For large surfaces it is usually put on in two coats, a rough and a finishing coat, as plasterers make a wall, when it may be painted or otherwise ornamented as desired.

The first non-conducting coverings used were made of wood, hair felt, paper, etc., but these, owing to their combustible nature, had to be constantly renewed. The felt coverings, also, being of a spongy nature, absorbed any moisture in their vicinity, thus not only destroying the fibers of the felt, but from their direct contact speedily corroding the metal surfaces they surrounded. Cements and compositions of fire-clay, asbestos, etc., were next used, but these, on large surfaces, not being able to withstand the expansion and contraction of the metals on which they were plastered, would crack and fall off. In many cases, also, the cements were so dense as to act as conductors of heat rather than the opposite. The "air space" method has none of these objections, the confined, dead air making the best non-conductor possible, while the frame holds the covering solidly under any plan of attaching the covering to a framework removed from the heated surfaces, hair felt, compositions, and cements, other than those containing asbestos, may also be used to advantage, as they cannot bring moisture to the metal to corrode it, and will not crack off from expansion and contraction, so that a much lighter covering will in this way be more effective than the heavy coats formerly used when applied directly on the surfaces.

The number of "test" trials to which the "air space" method of covering steam pipes, boilers, etc., has been subjected is very great, and they have extended over several years, in all cases amply proving everything that the company claim for it. This method was chosen as the best by the Commissioners and Chief Engineer of Machinery Hall at the Centennial Exhibition, and the company in this way covered all the pipes there and in the Annexes. In one of the tests made, where the "air space" method was brought into competition with their own surface covering and the coverings of other firms, under the most carefully guarded conditions, the "air space" method proved its superiority so decidedly as to distance all competitors. The trial was made by suspending a thermometer in an air-tight box, with a glass face through which its register could be observed, and running the steam pipes, protected by the various coverings to be tested, through this box; each test occupied an hour, the box being closed, for the commencement of the trial, when the temperature of 97° had been reached. In the cases where coverings of the pipes other than the "air space" was used, the temperature, with 10 pounds steam pressure, ran up to from 102° to 105° within 30 minutes, but with the "air space" covering the temperature could not be got up to over 90° in the open box, and with the box closed and the application of 14 pounds of steam reached only 94° after an hour's trial.

Many tests have been made as between steam surfaces covered and similar surfaces without any covering, but a noticeable one is mentioned in an account of some experiments by J. C. Hoadley on the economic effect of applying the Chalmers-Spence covering to a locomotive boiler, published in the *Journal of the Franklin Institute*, April, 1877, of which the following is a summary:

Steam Pressure.	Per cent Radiation, Boiler Uncovered.	Per cent Radiation, Boiler Covered.	Ratio of Saving by Covering.
130 to 140 lb. per square inch	13·7	5·8	42·2
120 " 130 " " "	13·3	5·3	40·4
110 " 120 " " "	12·9	5·7	44·3
100 " 110 " " "	12·8	5·7	44·8
90 " 100 " " "	11	4·9	44·8
80 " 90 " " "	10·7	4·3	40·5
70 " 80 " " "	10·2	4·3	42·2
60 " 70 " " "	11·3	4·5	40
50 " 60 " " "	10·6	4·6	43·8

The advantages of these coverings in the practical working of steam engines, and in manufacturing establishments where a great amount of coal is consumed, are shown in a marked diminution in the amount of fuel used, or a greatly increased steam pressure, or both.

This system not only saves the great loss of power which always attends the working of an engine when a portion of the steam has been condensed, which often occurs where an engine is run at a distance from the boiler, but it so helps to keep stored up the heat from the fires that a materially increased steam pressure is the invariable accompaniment of its adoption, so that, while it may not go far in aiding us to obtain in working power that theoretical value of coal for which all engineers are striving, its great economy in the way of saving the power which every one acknowledges is easily possible cannot be denied.

Besides owning the "air space" improvement, the company are manufacturers of various non-conducting compositions, hair felt, etc., and asbestos mill board, round packing, sheathing, wicking, and other articles of this class. They have factories at New York and Pittsburg, their New York office being at No. 40 John street, and they apply their improvements in every part of the country. The officers of the company are: John Roach, President; Geo. E. Weed, Treasurer; and R. H. Martin, Secretary and General Manager.

American Inventions Abroad.

A correspondent signing himself "Old Inventor," in the *Industrial Record*, published in London, calls attention to the alarming extent American inventions and machines are being introduced into England. Referring to the letter the editor quotes therefrom and comments as follows:

"In another column we publish a communication from an 'Old Inventor,' calling attention to the remarkably flourishing trade being carried on here in inventions, not of English origin, but of American production. 'Go where you will in London, American "notions," large and small, meet you at every turn—English inventions nowhere.' This is, no doubt, the case. We want no better evidence of the effect of the patent systems of the two countries. The smallness of the charges for a patent in the United States enables almost every inventor to protect his discovery, and to quickly find a market for it if it have any value, while the extortionate charges of the English tariff prevent all but a few from obtaining that protection which patent laws were designed to afford.

"But an 'Old Inventor' does not regard our scandalously bad patent laws as the only disadvantage which the British inventor suffers in comparison with his American rival. He finds in our moneyed and commercial classes a short-sighted disregard of the important services of inventors never characteristic of the same classes in America. 'Not only are her patent laws conceived and enforced for the encouragement and protection of inventors, but her capitalists and manufacturing classes are ever ready to assist inventors to develop and utilize their conceptions.' In the United States, 'let it be known,' he says, 'that an improvement has been discovered in machinery, a use found for a waste material, a new process devised in any industry, and the inventor has no difficulty in finding a market for his discovery.' Such, he adds, is not the case here. 'Let a man approach a manufacturer with a project for economizing labor, cheapening an article he is producing, or invite his attention to a new enterprise altogether, and he will be met with indifference, if not with suspicion, and dismissed as a "crazy inventor." Let him seek the assistance of a private capitalist, and he will fare no better. Rarely will he meet with sympathy or favor. Millions will be forthcoming in this country for any rotten foreign loan but to invest in a patent is a "risky speculation."'

"It must be acknowledged," says the editor, "that there is much truth in these remarks. If America has wanted money for any particularly rotten financial scheme, she has generally been able to get it here, but she has meanwhile been very careful to invest her own capital in the extension of her industries and the development of the inventive faculties and ingenuity of her citizens. We have by no means shown the same sagacity. But we think that the apathy and indifference to the claims of inventors which have distinguished us in the past, and must still, to some extent, be charged against us, are disappearing, and a more enlightened and enterprising spirit prevailing. But it has not been for lack of assistance and capital that the number of inventions lately taken up is not even larger than it is. The fault has been in too many cases with the inventors themselves. The value they put upon their own inventions is frequently very exaggerated, not to say absurd, and they defeat their own ends by the immoderation of their demands. When an inventor is content to rest his claim on the proved value of his invention, capital can generally be found to assist him, except where the invention is frivolous or manifestly worthless. If inventors would only bear this in mind, inventions of English production would be more frequently found in our markets and we should have less to fear from the formidable rivalry of America."

An Arctic Voyage Closed.

The unlucky Gulnare, of the Howgate Expedition, has returned to Newfoundland. The highest point reached was Disco Island, which the Gulnare reached August 9, badly battered by a storm. Two weeks were spent in repairing and taking in a half supply of coal. The return voyage was made mostly by sail, reaching St. John, September 24. Dr. Pavy, the naturalist, remained in Greenland to pursue his researches in natural history.

NEW INVENTIONS.

Mr. Benjamin Goodyear, of Carlisle, Pa., has patented a simple and inexpensive detachable bail or handle for crocks, that may instantly be applied or removed therefrom. The invention consists, essentially, of a stout wire bail in the shape of a figure 8, and having a curved clamp on each end, so that the said clamps shall be in a horizontal plane and with their concave faces opposite each other, so that when the clamps are applied to the opposite sides of a crock or other object, they will grasp the crock with a pressure dependent upon the upward pull exerted on the upper loop forming the handle of the device.

An improved faucet for dispensing mineral waters has been patented by Mr. John Collins, of Brooklyn, N. Y. The object of this invention is to furnish faucets for mineral water fountains, so constructed that the water can be introduced into the glasses without losing its sparkle.

Mr. Charles L. Bates, of New York City, has patented a gong bell, constructed so as to give a heavy blow with a short stroke. It can be adjusted for use as a right hand or a left hand bell, as may be required.

An improved wagon for gaseous liquid fountains has been patented by Mr. John Collins, of Brooklyn, N. Y. The object of this invention is to furnish wagons for gaseous liquid fountains, so constructed that the fountains will be securely held in place during transportation, and can be easily, quickly, and conveniently secured and released.

An improved berry basket holder has been patented by Mr. William J. Robinson, of Howlett Hill, N. Y. The object of this invention is to provide a simple device for holding a basket while picking berries, so that the berries shall not be spilled.

In the ordinary method of treating frozen paraffine oil for the separation of the oil from the wax, the frozen paraffine is inclosed in small cloths and folded and laid on plates in tiers of from twenty to twenty-five packages, and by the time the press is filled the frozen oil becomes warm, and consequently the crystallized wax melts and runs out as a liquid with the oil, and when the press is run down the wax in the cloths still contains oils, which renders it necessary for the wax itself to be again folded in cloths and again submitted to the action of the press, which process involves considerable labor, time, and waste of wax; and the wax is by this process rarely completely freed from the oil, while the oil always contains some wax, which injures the lubricating qualities of the oil. Mr. Herman Neahous, of Sharpsburg, Pa., has patented a process and apparatus that are free from the imperfections of the old method, and will make a thorough separation of the wax and oil, and do it economically.

Mr. Christian Heinzerling, of Biedenkopf, Germany, has patented a process of tawing hides for the purpose of adapting them to the uses of leather, which consists in first subjecting the raw hides to a solution of alum and zinc dust for the purpose of depositing amorphous alumina in the same, then to a solution of one of the chromic alkalies mixed with alum, or its described equivalent, and chloride of sodium, then fixing these in the hides by the chloride of barium, or its described equivalent, and finally greasing or fatting the hides.

How to Preserve a Carriage.

Mr. Starey, a prominent carriage manufacturer, of Nottingham, England, in a series of useful hints on their preservation, says that a carriage should be kept in an air tight coach house, with a moderate amount of light, otherwise the colors will be destroyed. There should be no communication between the stables and the coach house. The manure heap or pit should also be kept as far away as possible. Ammonia cracks varnish and fades the colors both of painting and lining. A carriage should never, under any circumstances, be put away dirty. In washing a carriage, keep out of the sun, and have the lever end of the "setts" covered with leather. Use plenty of water, which apply (where practicable) with a hose or syringe, taking care that the water is not driven into the body to the injury of the lining. When forced water is not attainable, use for the body a large soft sponge. This, when saturated, squeeze over the panels, and by the flow down of the water the dirt will soften and harmlessly run off, then finish with a soft chamois leather and oil silk handkerchief. The same remarks apply to the underworks and wheels, except that when the mud is well soaked, a soft mop, free from any hard substance in the head, may be used. Never use a "spoke brush," which, in conjunction with the grit from the road, acts like sandpaper on the varnish, scratching it, and of course effectually removing all gloss. Never allow water to dry itself on the carriage, as it invariably leaves stains. Be careful to grease the bearings of the fore-carriage so as to allow it to turn freely. Examine a carriage occasionally, and whenever a bolt or slip appears to be getting loose, tighten it up with a wrench, and always have little repairs done at once. Never draw out or back a carriage into a coach house with the horses attached, as more accidents occur from this than from any other cause. Headed, known here as top, carriages should never stand with the head down, and aprons of every kind should be frequently unfolded or they will soon spoil.

A carrier pigeon belonging to John C. Haines, of Tom's River, N. J., flew recently the distance of 36 miles in an air line in twenty-four minutes. Ten other pigeons released at the same moment reached home a minute later than their leader.

The Post-Glacial History of the Peninsula of Boston.

The geological history of the site of Boston, Mass., since the glacial epoch, is described as follows by Professor Shaler, in the history of the city called out by the 250th anniversary of its settlement:

"After the ice had lain for an unknown period over this region, climatal changes caused it to shrink away slowly, and by stages, until it disappeared altogether. As it disappeared it left a very deep mass of waste, which was distributed in an irregular way over the surface, at some places much deeper than at others. At many points this depth exceeded 100 feet. As the surface of the land lay over 100 feet below the present level in the district of Massachusetts Bay when the sea began to leave the shore, the sea had free access to this incoherent mass of *débris*, and began rapidly to wash it away We can still see a part of this work of destruction of the glacial beds in the marine erosion going on about the islands and headlands in the harbor and bay. The same sort of work went on about the glacial beds, at the height of 100 feet or more above the present tide line. During this period of re-elevation, the greater part of the drift deposits of the region about Boston was worked over by the water. Where the gravel happened to lie upon a ridge of rock that formed, as it were, a pedestal for it, it generally remained as an island above the surface of the water. As the land seems to have risen pretty rapidly when the ice burden was taken off, probably on account of this very relief from its load, the sea did not have time to sweep away the whole of these islands of glacial waste. Many of them survive in the form of low, symmetrical bow-shaped hills. Parker's Hill, Corey's Hill, Aspinwall, and the other hills on the south side of Charles River, Powderhorn, and other hills in Chelsea and Winthrop, are conspicuously beautiful specimens of this structure. Of this nature were also the three hills that occupied the peninsula of Boston, known as Sentry or Beacon, Fort, and Copp's Hills. Whenever an open cut is driven through these hills, we find in the center a solid mass of pebbles and clay, all confusedly intermingled, without any distinct trace of bedding. This mass, termed by geologists till or bowlder clay, is the waste of the glacier, lying just where it dropped when the ice in which it was bedded ceased to move, and melted on the ground where it lay. All around these hills, with their central core of till, there are sheets of sand, clay, and gravel, which have been washed from the original mass, and worked over by the tides and rivers. This reworked bowlder clay constitutes by far the larger part of the dry lowland surface about Boston; all the flat lands above the level of the swamps which lay about the base of the three principal hills of old Boston—lands on which the town first grew—were composed of the bedded sands and gravel derived from the waste of the old bowlder clay. These terraces of sand and gravel from the reassorted bowlder clay make up by far the greater part of the low-lying arable lands of Eastern Massachusetts; and of this nature are about all the lands first used for town sites and tillage by the colonists—notwithstanding the soil they afford is not as rich nor as enduring as the soils upon the unchanged bowlder clay. The reason these terrace deposits were the most sought for town sites and cultivation is that they were the only tracts of land above the level of the swamps that were free from large bowlders. Over all the unchanged drift these large bowlders were originally so abundant that it was a very laborious work to clear the land for cultivation; but on these terraces of stratified drift there were never bowlders enough to render them difficult of cultivation. The result was that the first colonists sought this class of lands. One of the advantages of the neighborhood of Boston was the large area of these terrace deposits found there. There was an area of 15,000 or 20,000 acres within seven or eight miles of the town that could have been quickly brought under the plow, and which was very extensively cultivated before the bowlder-covered hills began to be tilled."

Practical Value of Science.

BY PROFESSOR S. H. THOWBRIDGE, IN "THE ADVANCE."

Our obligations to the branch of physics are almost unlimited, but we will mention only two or three applications of a single agent in this wide field. It would seem to roll back the world into the dark ages to take from it now the benefits of electricity in its multiplied and yet rapidly multiplying applications.

It seems incredible, from our present standpoint, that so short time ago, in our congressional halls, the electric telegraph was almost ridiculed and voted into oblivion, from which it could never rise. When a bill was presented appropriating $30,000 to be expended, under the direction of the Postmaster-General, in a series of experiments to test the merits of Morse's electro-magnetic telegraph, one member moved an amendment requiring half the appropriation to be used for the encouragement of mesmerism. Another proposed to include Millerism in the benefits of the appropriation; others to appropriate part of the sum to a telegraph to the moon. And when the bill came to a final vote, this was so close that a change of three votes would doubtless have left us till this day without the benefits of the telegraph. After his invention was in working order, and transmitting messages between Baltimore and Washington, Mr. Morse offered it to Congress, to be attached to the Post Office Department, for the sum of $100,000. But it was declined, on the statement of the Postmaster General, who reported that, while the invention was "an agent vastly superior to any other ever devised by the genius of man," he was not satisfied that "under any rate of postage that could be adopted its revenue could be made to equal its expenditures." By this short-sighted want of appreciation of science, the United States government deprived itself of a source of revenue sufficient, doubtless, to liquidate the entire national debt in a single decade.

The application of electricity, now attracting world-wide attention, enjoys a vastly more hearty reception than did the telegraph. The *telephone* is constructed on the principle of the human ear. It consists of an elastic diaphragm, to receive vibrations of air from the human voice or from other sources, so connected with the wires of a battery (or even with wires without a battery) as to communicate the same vibrations in every respect to another membrane or diaphragm situated at a distance. The two diaphragms of a telephone in distant places correspond, in every practical sense, to the two membranes of the human ear, and the connecting wire to the chain of bones between the two membranes. Probably no invention has come more rapidly into popular favor. Already many thousands of them are in practical use in this country and abroad. "It is employed as a means of communication between counting room and factory, merchant's residence and the office, publishing house and printing office, and, in short, wherever oral communication is desired between persons separated by any distance beyond the ordinary reach of the human voice."

The speaking phonograph is also copied from the human ear. The vibrating diaphragm, in this case, has a stylus connected with it, which impresses the peculiarities of vibration, due to any particular sound, upon a roll of tin foil arranged to receive the impression. By reversing the process, the indentations and prominences of the tin foil cause the stylus to fall and rise, which results in vibrations of the membrane, and these reproduce the original sound. These impressed sheets of tin foil may be preserved or mailed to any part of the world, and by putting them into a similar instrument, may be made to reproduce the pitch, tone, and quality of the original sound thousands of miles or of years distant. By this instrument, voice may be phonographed, as the face is photographed and we may listen to the veritable voice of the dead, or preserve for future comparison the voice of a person from the first infant prattle and the manly utterances of mature life even to the feeble speech of old age. Public speeches and songs may thus be preserved and delivered indefinitely or till the tin foil wears out. In public libraries may be preserved languages of different nationalities spoken from century to century "with all the peculiarities of pronunciation, dialect, and brogue."

Correspondence.

A New Safety Sail Boat.

To the Editor of the Scientific American:

"Don't trust yourself in that craft; you'll be overboard sure." Such was the warning of a professional boatman at the barge office on the Battery, as I stepped upon a frail boat on a "fresh" afternoon. I think I know something of boats myself, and but that I knew this one to be provided with means intended to overcome the very danger against which the honest boatman warned me, I should have more than hesitated. But the pursuit of science must be deterred by no dangers, and, moreover, my pursuit in this instance was in behalf of the whole world, as represented by the SCIENTIFIC AMERICAN.

The Jane was an especially dangerous-looking craft, 18 or 20 feet long, whose bottom and deck formed the sharp V-shaped edge which proclaim an entire want of bearing power, while her immense sails, main and jib, were ample for a boat of twice her dimensions. Her captain was a New Zealander, whose motions were the reverse of safety-inspiring. My own conception of the care needful under the existing circumstances had no place with him, and, but for entire faith in my ability to swim, I should never have ventured.

As the Jane shot beyond the pier head, her huge sails were struck by a blast more than sufficient for instant destruction. Involuntarily I made ready for an impromptu bath, and the boatman tauntingly called out, "What'd I tell ye?" but *only the mast yielded*. The boat came to her bearings and moved on as steadily as though impelled by the mildest zephyr. The triumph was already complete; but more was to come. Presently we were in a large seaway, and, with our good speed, a large inflow of sea water over the low and sharp bow was a matter of course. In that, also, I was agreeably disappointed. The boat, instead of carrying the weight of the wind and being thus forced *through* the sea, rose to it and she glided easily *over*. Again it was the mast that yielded—yielded to the motion of the boat as easily as before it yielded to the force of the blast. The surplus force of wind, instead of racking the boat and making misery for her passengers, was simply "spilled" over the top of the sail. The motion was free from the thumps and jars usual under the same circumstances.

How all this was accomplished may be difficult of explanation without the aid of an engraving. Instead of being "stepped" in the usual way, the mast was held in a rocking shaft at the deck, and to the keel, on either side, springs were attached, having their opposite ends secured under the deck. Thus the mast, in the absence of pressure, remained upright, but under pressure yielded on either side. The amount of pressure needful to compel this yielding was regulated by nuts and screw on a guide rod inside the springs. A second pair of springs, placed longitudinally under the deck, were connected by pulleys with the shrouds, and these aided to stiffen the mast while they yielded to its movements under pressure.

For pleasure boats this spring mast is a great addition. It not only insures safety, but gives an ease of motion which cannot but prove especially delightful to those who are timid upon the water. More than this, it permits an unvarying course for the boat, and thus avoids the checks and delays inseparable from "luffing," as also the necessity of unusual skill and care in the management of even a "crank" vessel in a "flowy" wind. M. S. B.

New York, October, 1880.

[The invention, a practical trial of which is above described, is that of Mr. John McLeod, Hill's Pavilion, Flushing, N. Y. A patent has been allowed. It appears to be a really valuable and practical improvement.—EDS. SCI. AM.]

An Opening for Two New Articles of Manufacture.

To the Editor of the Scientific American:

I. In the Southern States 1,500,000 baskets are required for the harvesting of the cotton crop. These baskets are made of oak splits, and, except with extraordinary care, they last but one season, and are then thrown away. They require an expenditure on the part of planters of nearly $2,000,000 annually. Is it not possible that a basket may be made of iron, either wire or ribbons, which would last several seasons? The ribbons or splits might be made of some cheap quality of steel so as to be elastic, and if they could be made to weigh not more than 15 to 20 pounds each, and not to cost more than $2.00 to 2.50, they might prove a great success.

II. A great expense and trouble to the poorer people of the South is on account of cabin chimneys. On plantations and farms at a distance from cities, brick chimneys are so expensive as to compel owners of cabins to content themselves with stick and mud chimneys, which cost about $5.00 each, and which, if they do not burn up in the meantime, certainly fall down within a few years. A good substantial dirt chimney may be built up as far as the throat above the fireplace, but the shaft of the chimney, built of small sticks and daubed with mud, last but a brief time, and are always dangerous from fire. I would suggest to the manufacturers of concrete wares that a chimney stack with a flaring bottom (to sit on the dirt built jamb) might be constructed at a price which would commend it to the wants of thousands and tens of thousands of tenants of log cabins and cheap frame houses in this country. The form should be a square tube, 10 to 16 feet long, 16 to 18 inches square, flaring at the bottom to a size of 16x36 inches.

If there is any difficulty in this form, the flared portion and the stack might be constructed in different pieces, like joints of piping, with flanges to fit into each other. Here is certainly a great opening for industry in a new channel.

J. B. C.

Nodina, Ark., September 14.

AGRICULTURAL INVENTIONS.

Mr. Samuel E. Licklider, of Everett, Mo., has patented an improvement in the class of live stock feeders consisting of combined hay racks and mangers. The feature of novelty is the construction of the rack or hay receptacle and its arrangement relative to the manger.

Mr. Theodore C. H. Krüger, of San Marcos, Texas, has patented a machine for planting corn or cotton, that may be attached to almost any kind of plow. It is simple in construction, easily repaired by an ordinary blacksmith, and may be used for planting where stumps and rocks would interfere with the operation of machines of ordinary construction.

Big Farms on the Pacific Coast.

The "Mammoth Farm," of the Blacklock Wheat Growing Company of Washington Territory, comprises 60,000 acres of wheat land, of which 25,000 acres are fenced. Ground has been broken for a crop which is expected to foot up between 300,000 and 400,000 bushels.

Another large farm is that of Dr. Hugh J. Glenn, of California. It is in the Sacramento Valley, and comprises 65,000 acres, of which 45,000 acres were in wheat this year. The owner had provided 350,000 sacks, each holding 140 pounds, but at last reports they promised to be unequal to the task of holding the crop. Dr. Glenn has his own machine shops, blacksmith shops, saw and planing mills, etc. He manufactures his own wagons, separators, headers, harrows, and nearly all the machinery and implements used. He has employed 50 men in seeding and 150 in harvest, 200 head of horses and mules, 55 grain headers and other wagons, 150 sets of harness, 12 twelve-foot headers, 5 sulky hay rakes, 12 eight-mule cultivators, 4 Gem seed sowers, 8 Buckeye drills, 8 mowers, 1 forty-eight inch separator, 36 feet long and 13½ feet high, with a capacity of 10 bushels per minute; 1 forty-inch separator, 36 feet long; 2 forty-feet elevators for self-feeder, 1 steam barley or feed mill, and 2 twenty horse power engines. The forty-eight inch separator thrashed, on the 8th of August, 1879, 5,779 bushels of wheat.

RAPID TELEGRAPHING.—A political speech, of about sixteen thousand words, and occupying four hours in the delivery, was telegraphed to Cincinnati, from this city, September 24, in five hours and five minutes, by one operator on one wire. He used the Phillips system of steno-telegraphy.

A NEW ROAD WAGON.

The engraving shows a novel vehicle, having the combined advantages of a light speeding road wagon or adjustable vehicle for light and heavy work. It has a very light draught, and is easy riding. The friction on the axles and all of the wearing parts is light, and the shaft shackles, seat, and box are adjustable so that they may be readily adapted to their requirements.

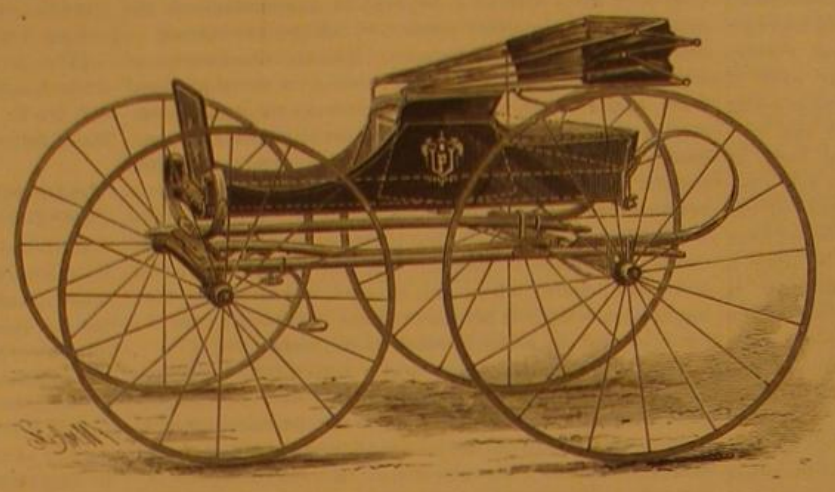
In this vehicle all the advantages of thorough braces and pliant platform are secured, with the addition of improved springs at the front and rear. The forward spring is of novel form, and arranged in line with the bolster, while the rear springs, which are of C form, are attached to and in line with the side bars. The springs are connected by leather or metal shackles with the bars attached to the slatted platform. The front bolster is connected with the rear axle by a central reach and by side bars which are secured by braces, clips, and bolts.

The platform is composed of slats which are thick in the middle and taper toward the ends. This construction gives strength and elasticity. The seat and box have curved bottoms to conform to the curvature of the pliant platform, and are made adjustable. There is no draught on the springs, platform, or box, and the friction and jar or quiver on the axles, wheels, king bolt, and shaft shackles are reduced to a minimum.

The springs have solid heads or metal tips, which render them stronger and more durable, and reduce the tendency to rattle. The springs, together with the pliant platform, form a combination which secures great elasticity and avoids most of the jar common to other vehicles when driven over obstructions, rough pavements, railroad crossings, crosswalks, ditches, etc., and it has very little swing or dip, and readily adapts itself to uneven roads, and, finally, it is peculiarly adapted for speeding and road purposes. It is used with or without a box, and it may have one or two seats or one or more boxes.

This wagon is made in different styles to adapt it to the wants of purchasers. It is made very light for speeding, a little heavier for physicians' use or for light driving. Another style is suited for liveries and general use; still another for farmers' use, provided with adjustable seat and box. A wagon is also made on the same general plan for sewing machine agents, grocery men, light express, and general use; and a still heavier wagon has two or more seats, and is well calculated for carrying a number of persons comfortably.

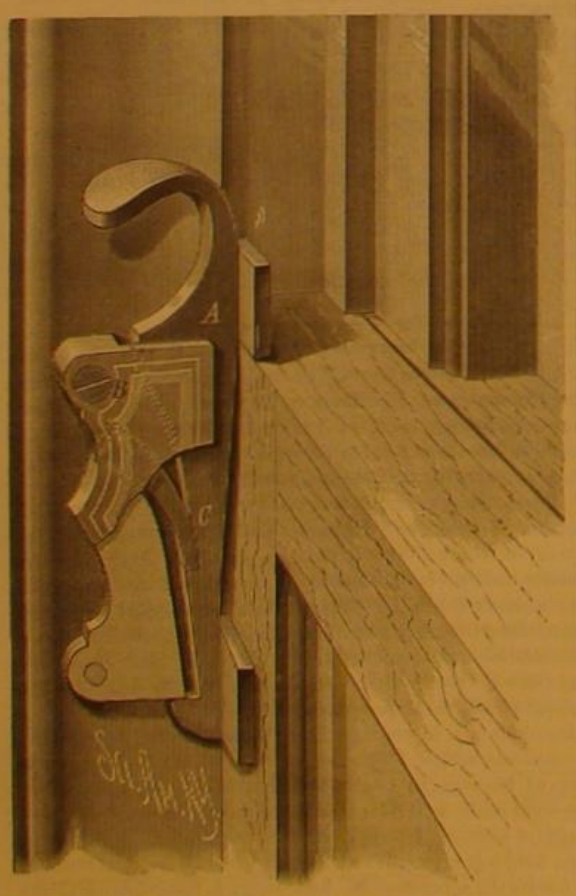
This improved vehicle was recently patented in the United States and Canada by Mr. James L. Phillips, box 342, Lowville, Lewis county, N. Y.



PHILLIPS' NEW ROAD WAGON.

NEW SASH HOLDER AND FASTENER.

The engraving shows an improved sash holder and fastener recently patented by Mr. John Harley, of Wallaceburg, Ontario, Canada. The device is very simple, consisting of three principal parts: the wedge, A, casing, B, and the rubber spring, C. The upper end of the wedge is provided with a handle, and two flanges project from its face, one near the top and the other at the bottom. The back of the wedge has a notch near the middle to receive the end of the rubber spring, C. The casing, B, is secured to the window stop, and has a curved recess which contains the larger end of the rubber spring, C. The lower end of the wedge has a nib which prevents it from being drawn out of the casing.



HARLEY'S SASH HOLDER AND FASTENER.

When the window sash is raised the wedge is drawn by friction partly out of the casing and does not interfere with the opening of the window; but as soon as the sash is released the friction between the sash and the wedge draws the latter down into the casing and clamps the sash tightly, preventing it from descending further. When it is desired to close the window, the wedge is pulled upward, releasing the sash, when the window may be closed. The window is fastened, when closed, by hooking the flange near the upper end of the wedge over the top rail of the lower sash, as shown in the engraving.

Further information in regard to this invention may be obtained by addressing the inventor as above.

Brewers' Patent Suits.

The appointment of an advisory committee by the United States Brewers' Association, to counsel brewers who are attacked by "patent sharks" as to their best methods of defense, and if possible to combine interests in a common repulse, was decidedly a step in the right direction. "A child may lead a horse to water, but no man can make the horse drink." The advisory council exists, and so do patent sharks, but they have not as yet come in contact.

We are given to understand that ten or a dozen suits are pending against brewers in New York and vicinity for an alleged infringement of a patent that has been held in abeyance for a number of years, relating to the pitching of casks, etc., by means of hot air. Shultz, of Philadelphia, a long time ago, patented an arrangement for blowing hot air through a furnace into casks, heating them thoroughly so that the pitch would readily spread, thus saving much trouble. The principle was crude, and as times go it was antique. Stromberg, of Baltimore, improved on it. Holbeck went one better, and at last Gottfried, of Chicago, "collared the pot," and rested content until some one discovered that brewers were making a soft thing out of the "pitching patent." The cost of a machine was about $200, which sum fully covered the principle and the cost of apparatus. There was not enough money in it to "run" a big factory or to make a large income, so the patent fell flat, and was used by any ingenious smith who cared to apply it. Things went on thus until a celebrated firm of lawyers in Chicago "smelt blood," revived the patent, prosecuted claims, frightened some into compliance, and at last instituted suits for damages against brewers using the machine, in some instances, we are told, to the amount of $15,000, in equity. They expect, it is said, to hop out of New York with at least $200,000 damages obtained against brewers who have used this precious hot air arrangement. Those who have settled are referred to in proof of the validity of the claim, and an eminent trade journalist in Chicago gives testimony in its favor. We expect to hear of a patent on the breath of heaven yet.

To show the value in equity of this precious patent, we may state that on Wednesday, Sept. 15th, Henry Guenther, of the John Kress Brewery, New York city, pitched, on the old principle—*i. e.*, unhooping and taking out the head of the keg—twenty-four quarters in twenty-five minutes, beating the patent pitching machine all hollow, especially as to equity. For proof we refer to Mr. Stenger, of Eckert & Winter, and to Mr. P. Hoffmann, and to many others who witnessed the operation. Patent claims, in equity, must be careful in particularizing.—*Brewers' Gazette.*

A New Oil from Grape Vines.

The introduction of American vines into France to resist the ravages of the phylloxera is likely to receive a check, since it is claimed that only six or seven varieties do resist the insect's attacks successfully, while none of them produce wine as good as that obtained from the French vines. M. Laliman, a French *savant*, has discovered, however, that an oil can be distilled from the American vines which will not congeal above 8° Fah., while other oils congeal at 27½° Fah. M. Laliman, therefore, recommends this oil for watchmaking and similar uses.

MECHANICAL INVENTIONS.

An improved car coupling, patented by Mr. William R. Firebaugh, of Danville, Ill., consists of a link fastened to a shaft passing through and loosely mounted in a drawhead provided with a hook and a buffer, upon which shaft a cam provided with a weighted latch and acted upon by a locking spring is rigidly mounted. The shaft of the cam can be rotated by means of a crank shaft and chains, or by a crank directly, by this means the pivoted link is engaged with or disengaged from the hook on the opposite drawhead.

Mr. William B. Padgett, of Batesville, Ark., has patented an improved press for cotton, hay, or other material, that may be operated by hand or other power. The invention cannot be described without engravings.

Mr. Christopher C. P. McCord, of Walnut Grove, Ark., has patented a safety pulley for cotton gins and other machines, the object being to furnish devices by which the power may be quickly disconnected from the machine in case of accident.

A motor for driving sewing machines and other small machinery by either weight or spring power, has been patented by M. Léonce P. Ducournau, of New Orleans, La. The invention consists in a novel arrangement and combination of springs, gearing, and a fly wheel, and devices connected therewith which cannot be readily described without engravings.

Messrs. James A. Mell and Wesley Wortenbe, of Moline, Mich., have patented a self-adjusting wrench especially adapted for heavy work. It consists, essentially, of two jaws with legs of different lengths pivoted together; the longer jaw being also pivoted to a handle in such a manner that either or both jaws can swing and increase or diminish the opening between them within certain limits, as may be desired.

An improved rotary engine or pump has been patented by Mr. William B. Espent, of Spring Garden, Jamaica, West Indies. The invention consists in certain novel features of construction whereby the inventor obtains a minimum of friction surface with a maximum of piston space and speed and a reduction of joints requiring to be packed.

A NEW COMBINED BAROMETER AND THERMOMETER.

The engraving shows a short-leg mercurial barometer and thermometer combined. It consists of three tubes about half full of mercury dipping into a sealed cistern, B, full of the same. The tube, A, is open to the air; the tube, C, has at its top a sealed globe, D, full of air. Now, taking these two tubes alone, any variation in the atmospheric pressure would cause the mercury in A to rise or fall, communicating its movement to the mercury in C; but any variation in temperature would also move the mercury by expanding or contracting the air in the globe, D. To counteract this influence, which would in some cases materially alter the readings of the barometer, another tube, E, is arranged with a long bulb, F, something like a Sixe's thermometer; this tube, E, is, like the other, about half full of mercury, the rest of the tube and the bulb being filled with spirits of wine. Now the action of this thermometer for an increase of temperature is as follows: The spirit expands and drives the mercury into the other two tubes, but the air in the globe also expands by the heat, and prevents the mercury rising in the tube leading to it. All the rise of the mercury, therefore, takes place in the open limb, and exerts a greater pressure on the air within the globe, and thus prevents it from expanding; the height, therefore, of the mercury in the limb leading to the globe is not altered by differences of temperature, and it gives the reading of the barometer. A decrease of temperature acts in an opposite direction; the spirit then contracts, draws the mercury from the open limb, and reduces the pressure upon the air within the globe, which is thus prevented from contracting, so at all temperatures the volume of gas remains the same. Practically it is not altered by differences of atmospheric pressure, as the space in the globe is some hundreds of times larger than the space occupied by the variation of the mercury. The tube, E, also serves as a thermometer, for the spirit is, of course, incompressible. We have not yet heard how far the compensation is practically effected, but the design is certainly very ingenious.—*E. H. Hills, in English Mechanic.*

Combined Barometer and Thermometer.

A MARINE COMMUNITY.

BY A. W. ROBERTS.

One of the most intensely interesting occupations that I ever entered into was that of dredging for specimens of marine life. I have drawn and engraved but a mere fragment, so to speak, of some of nature's wondrous handiwork secured during a day's dredging at Buzzard's Bay, Mass.

In this marine community fraternity and equality were exhibited in a manner far superior to any republic, ancient or modern. But there was very little liberty, particularly in the case of the old hermit crab, whose residence was the empty shell of a winkle, which was so occupied by a living community of annelids, zoophytes, shellfish, etc., that it was next to impossible for him to navigate. Yet with these curious creatures communism prevailed to its fullest extent,

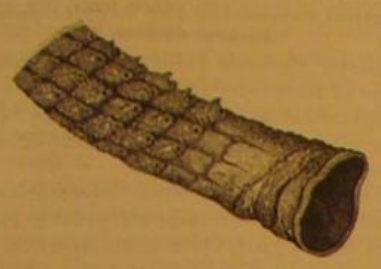


Fig. 1.—Lepralia.

one for all, and all for one. This mass of marine animals lived and thrived at the Aquarium for many months.

To begin, then, with the worms (or annelids, as they are called) contained in this community, I will select the *Serpula dianthus*, shown in the illustration as the central figure, and over which is shown a sea horse watching and waiting for small annelids, that he may suck them out of their tubes with his proboscis-shaped mouth.

The tubes in which the *Serpula* live are composed of shell. When a tube is broken it is immediately repaired or built up again by the *Serpula*. The *Serpula dianthus* always grows in a mass. At the base of the mass the tubes are twisted and contorted together, and where they come in contact with one another the outer walls of the tubes are joined together. In this way this united worm community obtain mutual strength for their otherwise fragile homes.

If a group of these annelids be taken into the hand they will appear to be empty, but if the tubes be not greatly contorted a something scarlet may be seen some distance down the tube, and by that sign the *Serpula* is known to be alive.

When *Serpulæ* are first placed in an aquarium they remain quiet for several hours, as if to become acquainted with the surroundings; but by very slow degrees the scarlet object is pushed nearer and nearer the mouth of the tube, and at last emerges, when it is seen to be a conically-shaped cork or stopper, its small end being prolonged into a kind of footstalk. In a short time a circle of scarlet feathery objects slowly and cautiously follow the stopper, which spread themselves out into a beautiful and elegantly-shaped plume. This plume is the feeding apparatus by which the minute forms of animal and vegetable life are arrested and conveyed to the stomach. Slowly as the *Serpula* protrudes itself from its tube, it is by no means slow in retreating. When one of these creatures is fully expanded in an aquarium, and the hand is rapidly moved outside without even touching the glass, the worm pops back into its tube with marvelous rapidity, so rapidly that the eye fails to follow the movement. The shadow of a person passing by will often have the same effect. It seems evident that the *Serpula* must be able to see, yet no eyes have been discovered.

The apparatus by which the *Serpula* performs its upward movement is a marvel of nature's mechanism. The body of the annelid is composed of seven distinct segments, and from each of these projects a pair of tubercles, each containing a bundle of bristles which can be thrust out at the will of the animal; at the end of each of the bristles are four short points, one being longer than the others. In ascending these bristles are thrust against the inner walls of the tube, which gives the creature an upward movement; contraction follows, when the hinder set of foot-like bristles are brought up, and so the movement is repeated till the end is accomplished. I extract the following from "Ocean Wonders," by my friend, W. E. Damon:

"Another curious little animal, also an annelid, is generally to be found rearing its cosy home amid the tubes of the *Serpulæ*. It cannot boast, perhaps, of as much beauty of color and waving plume, but its habits are so interesting and really wonderful, that I think it takes the lead as an object of curiosity of all the tube-building fraternity. Its tube is not homogeneous in its composition like that of the *Serpula*, but it makes an aggregation of separate particles, artistically welded or fitted together like a piece of mosaic work. This tube is not a secretion, like the cell of the coral-polyps; it does not *grow*, but is voluntarily and with great skill and care built up by the animal. In its construction it will use the very finest material—little specks of fine sand, and even dust that may chance to fall on the surface of the water. It also discriminates as to color, apparently preferring the brighter particles. For instance, I have ground red coral to powder, and put it into the water; upon this the little annelid would promptly seize, and immediately appropriate it for building purposes.

"A casual observer might see this wonderful worker many times without perceiving or appreciating its artistic movements; but get him once under a good lens, and you will see not only all the machinery in full operation, but also the object of its unwearied toil. Indeed this busy little work-

Fig. 4.—Chiton.

Fig. 5.—Purple Sea-urchin.

man lifts and carries bits of stone (hypothetical bricks), grains of sand, coral, glass, or shell, or any atoms which will serve its purpose, raises them to the top of its unfinished walls, and there places them with as much precision, neatness, rapidity, and in as regular order as the most experienced bricklayer. It is perfectly marvelous. One might watch them for hours together and never grow weary.

Fig. 2.—Hydractinia.

"But *how* do they do it?

"When the operation is seen, it is easily comprehended. The explanation presents some difficulties, though I have seen them build enough to create an annelidan city; but we will try to make it clear how the material for the construction of this little ocean tenement is hoisted up and placed in exactly the right position to complete its circular walls.

"In the first place, the creature has some twenty or thirty long, hair-like arms, which it propels out of the end of its tube. Extending these in every direction and to an incredible length, they become so attenuated as to be scarcely discernible in the water; but these fine, delicate cords or filaments, hardly discoverable by the unassisted vision, may be considered the ropes or tackling of its machinery for collecting the material which it needs for its sheath-like dwelling. Suppose a grain of sand, for instance, is lying at some distance from the animal: by some sense it perceives it, determines to appropriate it, and immediately sends forth one of its long, slender threads—*over* it or *to* it, for the extreme points are so fine as to be distinguished with difficulty, but the grain is reached. Watch it closely now! See! the bit of sand begins to move gradually along and upward, *gliding upon the surface* of this serviceable, rope-like filament. Observe, it is not grasped pincer-like with the end of the filament, but rides upward on the thread like that mysterious little wheel which thousands of our citizens see daily creeping up and over the wire which is one day to be a strand in the great cable of the East River Bridge. What the propelling or attracting force is which causes the grain of sand to rise up against the laws of gravity and approach the mouth of this annelid, I have not yet been able to discover; but in all probability there is a system of muscular contractile organs in this fine filament which a sufficiently strong magnifying lens may yet bring to observation and recognition. Be that as it may, we will in the meantime watch for what we can *see* of this process, and we find that when the object has reached the end of the filament it is placed for a moment in the mouth, where it is evidently coated with a glutinous

Fig. 3.—Crepidula Fornicator.

mucus and is then passed out again, and finally deposited upon the edge of its walls. The true level is kept, one side being built up at exactly the same rate as the other, so that no excrescences are left on the edge, but when finished, all is of a uniform and even surface. The general appearance of the animal when at work forcibly reminds one of an immense *derrick*, full-rigged and in vigorous operation."

For feeding *Serpulæ* I used the stomachs of oysters and clams ground to a smooth paste, which were diluted with water. When this substance was mixed with the water of the aquarium it caused the water to assume a very milky appearance, which in a few hours time became as clear as crystal, after being worked over by the *Serpulæ*, which had devoured all the oyster held in suspension. On the tubes of most *Serpula* will be found a reddish-brown or gray incrustation; this incrustation is called *Lepralia*, and consists of innumerable spine-crowned cells of exquisite structure arranged in rows like the scales of a fish, as shown in Fig. 1, when greatly magnified. Each cell is armed with a spine. If the fingers are passed over the surface of the *Lepralia* from the base of the *Serpula* tubes upward a peculiar rough and harsh sensation will be perceived, which is caused by the finger coming into contact with the thousands of spine-crowned cells. In the channels of Canarsie Bay, Long Island, this zoophyte is found encrusting shells and other objects which have been submerged for any length of time.

On certain parts at the mouth of the winkle shell, which were free from the abrasion of the hermit crab's claws, grew a thick rose-colored moss-like carpeting, which consisted of thousands of minute hydroids called *Hydractinia*.

All members of a *Hydractinia* colony are connected at the base by a horny network, which rises occasionally into points of a conical shape. A single individual of such a colony when placed under a microscope appears as shown in Fig. 2. The pear-shaped protuberances, which might be taken for buds, in course of time burst and send forth a crystal bell, no larger than a pin's head, but of perfect organism. These are the minute jelly fish (*Medusæ*) that crowd the ocean in countless numbers, illuminating the crest of every tumbling wave and marking the wake of every ocean steamer.

Fig. 3 represents a mass of shell-fish (*Crepidula fornicator*) adhering together; the lowest one in the mass was fastened so firmly to the winkle shell that it could not be removed without injury. These "boat shells," as they are commonly called, adhere by means of atmospheric pressure; raising the central parts of their bodies from the objects to which they are attached, and, pressing down the rim of their shells, they produce a vacuum beneath themselves. And so firmly does the air hold them in place that the unaided fingers will find great difficulty even to stir them. The rims of their shells always exactly fit to the object or convolution of the shell to which they are attached. At the mouth of the winkle shell were also attached a number of living specimens of *Crepidula plana*.

Fig. 4 represents a curious little creature which I found tucked away in the interstices formed by the *Serpula* tubes. In color he so exactly matched his surroundings and was in form so very flat and unobtrusive that almost any one would have overlooked him. With his eight movable plates on his back he was suggestive of a tiny marine armadillo; but when I picked him out from his hiding place, which was no easy task (as he can maintain a better vacuum than the boat shell), he curled himself into a ball which you would have pronounced to be a very aged pill-bug (*Oniscus*).

In the mass of *Serpulæ* I also discovered several very young specimens of the purple sea-urchin, Fig. 5. The shell of the sea-urchin is made out of several hundreds of pentagonal plates, varying in size according to their position. These are so closely connected that their marks of juncture are not perceptible. As the

A MARINE COMMUNITY

shell is composed of these plates it is wonderful how the creature increases in size, as it cannot, like the crab, cast its old shell when too small and take to itself a larger one. But in order to overcome this the delicate lining membrane with which the entire surface of the body is covered insinuates itself between the edges of these plates and deposits round the margin of each particles of calcareous matter, so that each plate simultaneously increases round its edges, and the original form of the shell is preserved.

The surface of a sea-urchin after a certain age becomes thickly studded with spines (in young specimens the spines are much less in number), which are employed as a means of locomotion, and therefore are freely movable. If a single spine be removed, and note taken of the part it previously occupied, it will be seen that on the shell is placed a rounded tubercle, and that the base of the spine is furnished with a hollow socket into which the tubercle fits, so that the spine has perfect facility of movement. The spine is bound to the tubercle by a tendinous ligament, connecting the center of each much as is the case with the larger joints of vertebrate animals. The power of motion is communicated by the membranous covering that envelops the body during the life of the animal.

Besides the animals I have described as being members of the marine community, were also very small clump-clawed crabs, numerous *Neris* worms, a small variety of the *Cardum*, and minute acorn barnacles. In fact this single mass contained enough animal organisms to stock an aquarium for many months' study. The young sea-horses were introduced into the aquarium occasionally that they might enjoy an extra feed of small annelids.

THE KING PENGUIN.

Most interesting, by far, among all rookeries of penguins which I have seen was one of king penguins (*Aptenodytes longirostris*) which I met with at Marion Island.

The rookery was on a space of perfectly flat ground of about an acre in extent. It was divided into two irregular portions, a larger and smaller, by some grassy mounds. The flat space itself had a filthy black slimy surface; but the soil was trodden hard and flat.

About two-thirds of the space of one of the portions of the rookery, the larger one, was occupied by king penguins, standing bolt upright, with their beaks upturned, side by side, as thick as they could pack, and jostling one another as one disturbed them.

The king penguins stand as high as a man's middle. They are distinguished at once not only by their size, but by two narrow streaks of bright orange yellow, one on each side of the glistening white throat.

Penguins were to be seen coming from and going to the sea from the rookery, but singly, and not in companies like the crested penguins.

The king penguins when disturbed made a loud sound, like "*urr-urr-urr.*" They run with their bodies held perfectly upright, getting over the ground pretty fast, and do not hop at all.

A good many were in bad plumage, moulting; but there were plenty also in the finest plumage.

On the small area of the rookery, which consisted of a flat space sheltered all round by grass slopes, and which formed a sort of bay among these, communicating with the larger area by two comparatively narrow passages, was the breeding establishment. These penguins are said by some observers to set apart regular separate spaces in their rookeries for moulting, for birds in clean plumage not breeding, and again for breeding birds. Here the breeding ground was quite separate, and the young and breeding pairs were confined to this smaller sheltered area. This was the only king penguin rookery which I saw in full action.

At Kerguelen's Land the king penguins were only met with in scattered groups of a dozen and twenty or so, and they were then not breeding, but only moulting. On this breeding ground, at its lower portion, numbers of penguins were reclining on their bellies, and I thought at first they might be covering eggs; but on driving them up I saw they were only resting. There was a drove of about a hundred penguins with young birds among them.

The young were most absurd objects. They were as tall as their parents, and moved about bolt upright, with their beaks in the air in the same manner; but they were covered with a thick coating of a light chocolate down, looking like very fine broom-fur. The down is at least two inches deep on the birds' bodies, and gives them a curious inflated appearance. They have a most comical look as they run off to jostle their way in among the old ones. They seemed to run rather better than the adults, but perhaps that was fancy.

Absurd in appearance as these young are, those that are just dropping the down and assuming the white plumage of the adults, are far more so. Some are to be seen with the brown down in large irregular patches and the white feathers showing out between these. In others the down remains only about neck and head, and in the last stage a sort of ruff or collar of brown remains sticking out round the bird's neck, and then when it cocks up its head it looks like a swell boy in stick-up collar.

The manner in which these young ones cock up their heads gives them a peculiar expression of vanity, and as they ran off on their short stumpy legs I could not resist laughing outright.

At the farthest corner of the breeding space, in the most sheltered spot, was a clump of birds of a hundred or more. The birds were, most of them, in a slightly stooping posture, and with the lower part of their bodies bulged out in a fold in front.

As I came up and bullied these birds with my stick a little they shifted their ground a bit with an awkward sort of hopping motion, with the feet held close together. It immediately struck me that they were carrying eggs with them, as I had read that king penguins do. Their gait was quite peculiar and different from the ordinary one, and evidently labored and difficult.

I struck one of them with my stick, and after some little provocation she let drop her egg from her pouch and then at once assumed the running motion.

These birds carry their eggs in a complete pouch between their legs, and hold it in by keeping their broad web feet tucked close together under it. They make absolutely no nest, nor even mark from habitually sitting in one place, but simply stand on the rookery floor in the described stooping position, and shift ground a bit from time to time as occasion requires. I suppose the egg is not dropped till the young one begins to break the shell.

Charles Goodridge says that the period of incubation is seven weeks, and that the birds commenced laying in the croyets in November, and continued to lay, if deprived of their eggs, till March. The birds with eggs were sitting close together. When, on my frightening them, some were driven against others, savage fights ensued and blood was drawn freely, the birds whose ground was invaded striking out furiously with their beaks.

Round about the brooding birds were others, I think males, in considerable numbers. The males probably feed the females with which they are paired. There were also some young downy birds.

If one of these latter was driven in among the brooders it was at once pecked almost to death. The young ones utter a curious whistling cry, of a high pitch and running through several notes, quite different from the simple bass note of the adults.

The egg of the king penguin is more than ordinarily pointed at the small end. It is greenish-white, like other penguin eggs.—*H. N. Moseley, Challenger Notes.*

The Menominee Iron Mines.

A correspondent of the *Iron Age*, accompanying the American Institute of Mining Engineers on its excursion among the mining districts of Lake Superior, anticipates a revolution in iron making to result from the inexhaustible stores of cheap ore in that region. He says:

We have questioned the propriety of calling some of the great openings of the Marquette and Negaunee districts "mines," as they might with more propriety be called "ore quarries;" but what shall we call these Menominee openings? They are not even quarries. You strip off the surface, and beneath lie deposits of ore such as the eye of man hath not seen. We are amazed, astounded, confused. Some of us who are interested in Eastern mines even turn away disgusted; and what wonder, when we see miners working these vast deposits of steel ore with pick and shovel as easily as they would dig a cellar on a sand hill; when we see ore of unapproachable richness and purity loosened, loaded, and put in cars for 25 cents a ton, including everything except the royalty of 50 cents. We have been impressed from the first; now we are appalled. I do not exaggerate in any respect the feelings of those who saw these mines for the first time on Tuesday, and who had enough acquaintance with the iron trade to understand the meaning of what they saw. "There is nothing like it in the world," says every one, and no one can intelligently question the statement that in this Menominee range, with its incalculable wealth of ore in sight and its unlimited possibilities of development, has been found the solution of the ore question for a longer time into the future than any one now in the iron business has any occasion to look. . . . Description cannot do justice to the subject, any more than it could to the Falls of Niagara. Even when we see the falls we wonder how this mighty cataract is fed, and when the supply of water which pours over the precipice in never diminishing volume will be exhausted. But our question is answered when we cross the great inland seas which are its unfailing fountains. So it is with Lake Superior iron ores. We see them steadily flowing into the port of Cleveland in increasing volume, and have allowed ourselves to be deluded by the mistaken predictions of such authorities as Mr. Bell, that they are drawn from pockets of known extent, and that the end of the supply can be predicted. When we go and look for ourselves we see that the supply is not a matter of years, but of centuries; that as yet we have but scratched the surface of a mineral wealth for which the world has no parallel, and that within two or three years at most, the abundance and cheapness of these ores will so reduce the cost of iron as to materially change the condition of national industrial development and international competition. If any one doubts this let him go and look, and his eyes will be opened. For the first time your correspondent appreciates the value of the Lake Superior ores as a factor in the problem of our iron development.

The Menominee range is the latest and grandest development of this wonderful country. In 1877, 10,405 tons of ore were shipped; in 1878, 94,245 tons; in 1879, 269,089 tons. This year there have already been shipped 375,000 tons, and before the close of navigation between 500,000 and 600,000 tons will have gone forward. Every pound of this ore will make Bessemer iron. The average cost at all the mines will not exceed $2 per ton on cars. In the furnace they will melt like snow. In one instance the ore costs 20 cents a ton at the surface, and with a total force of 60 men at work the mine yields 400 tons per day. Nothing is shipped which does not contain 55 per cent of metallic iron or over. The 50 per cent ore is piled near the workings in the expectation that in the event of a sudden demand it may be wanted. This production can be increased as rapidly as it may be needed, and there will soon be no room for foreign Bessemer ores in a market so abundantly supplied from Michigan and Wisconsin. The time is not far distant when this ore will be delivered at Cleveland at $4 per ton, leaving the mining companies $1 per ton profit. At this point the purest ores will meet the Connellsville coke, the finest metallurgical fuel in the world, and the pure magnesian limestones of the lake shores, than which there are no better. The rest may be guessed.

Original Inventions and Supplementary Improvements.

The *Telephonic Exchange Reporter*, in its allusion to the large number of patents issued on the telephone since Professor Bell introduced his instrument, adds the following remarks concerning the importance of patenting supplementary improvements.

When an inventor, says the writer, files a proper application for a patent, the government will grant to him a patent for whatever he can justly claim as his invention. Such invention properly belongs to the inventor, not by reason of a government privilege, but by reason of his having been the creator of the property. The government grants no privilege; it simply recognizes a legal right. The Patent Office makes an examination into the novelty of the invention in order that official recognition may be given only to that which appears to be new. If the official inquiry be not subsequently proven at fault, the invention or improvement patented is solely for the use or let of the patentee. He may let it drop, and thus make nothing from it. He may put a prohibitory value on it, and thus get nothing from it. He may put a just value on it and reap a rich reward, if his invention has merit. The justness of the inventor's charges will be evidenced entirely by public acceptation. If he charges too much the public decline his invention.

Another man may add an improvement to the original inventor's device. The improvement may consist of an added element, or in a useful change in form of old elements. The improver can patent his improvement.

The fundamental invention thus belongs to the first man, and the improvement belongs to the second man. The first man is not at liberty to make, sell, or use the improvement without the consent of the party who owns the patented improvement.

The second party is not at liberty to make, sell, or use the fundamental invention without the consent of the owner of the patent on the fundamental invention. In the absence of an arrangement, the first party must do without the improvement, and the second party must do without the fundamental invention. The first party can operate his invention without the improvement, but the second party can do nothing with his, because he has no fundamental invention to which he can apply his invention. He invented and patented his improvement with the hope that the owner of the fundamental patent would appreciate its merits and arrange for the use of the improvement. Without the allowance of the fundamental inventor, the improver is rock bound. He may have fine quarters on an upper floor; quarters which the party down stairs might envy him the possession of, but if the down stairs party has a sole title to stairs and exit, the up stairs party must leave his quarters vacant, or come to terms with the base.

In the case of patented inventions there may be hundreds of improvers on a fundamental invention; there may be improvements on the improvements; and many of the improvements may not be improvements at all, but may be fallacies based on wrong observation or incorrect experiment.

The status of patents is generally well understood by inventors, and they also well understand that the reward of the improver is likely to be handsome if his improvement will create a marked advance in the merit of the invention improved upon. The wise inventor does not cease his labors because his invention is a tributary one. Howe patented the essential fundamentals of sewing machines, but Singer was not thereby deterred from patenting an improved Howe sewing machine which he could never make without Howe's consent.

Bee Keepers' Convention.

The eleventh annual convention of the North American Bee Keepers' Society met in Cincinnati, Ohio, September 29. About one hundred and fifty delegates, from nearly all the States of the Union and from Canada, were present at the first session. In the annual address by President W. T. G. Newman, of Chicago, the honey crop of this year was said to be but half the usual amount, owing to bad weather. Papers were read on honey-producing plants and trees, new discoveries in the cure of foul brood, the yellow race of bees, Cyprian bees, etc.

The Cologne Cathedral.

Since 1821 the public and private contributions to the building fund of Cologne Cathedral have amounted to $4,500,000. Adding the contributions of past centuries, notably the money expended on the colossal foundations, a German paper finds that as it now stands the cathedral represents about $10,000,000.

Treatment of Nickel with Phosphorus.

M. J. Garnier, of the French Academy of Sciences, recently presented the following interesting paper to that body, giving the results of his experiments with nickel:

Pure nickel after melting generally contains more or less oxygen, and the metal is brittle. To prevent this injurious action of the oxygen, it is necessary to incorporate with the molten nickel a substance which has a great affinity for oxygen, but which shall also have a great affinity for the nickel itself; furthermore, this substance must not make the nickel brittle. The injurious action of the oxygen is proven by the fact that pure nickel melted in an atmosphere free from oxygen is extremely malleable. Such is the case with that which is accidentally deposited on the nozzles of the furnace blowers surrounded by combustible material. This same nickel, remelted or simply brought into contact with the air while at red heat, may then be pulverized under the hammer. Satisfied of this fact since 1876, I thought of adding metallic manganese to the metal, as is done in making steel. I chose manganese as the proper combining substance on account of its low price in the state of ferromanganese; but other easily oxidizable metals, it is needless to say, would have given the same results.

The manganese, it is true, did improve the quality of the nickel; but, like all metals having a great affinity for oxygen, it disappeared after successive remeltings, leaving the nickel again brittle. Thus I found that the oxidizable metals would not serve my purpose in practice, and I then employed phosphorus with success.

Besides the advantage of not perceptibly diminishing in remelting, when used in the small quantity necessary, phosphorus absorbs a much greater quantity of oxygen than any metal that can be used for the same purpose, using equal weights; thus while one unit of phosphorus absorbs 1·25 of oxygen in passing into phosphoric acid and 1·50 in passing into simple phosphate, one unit of manganese will absorb only 0·30 of oxygen in becoming protoxide of manganese; one unit of zinc will take only 0·25 of oxygen, and one unit of magnesium only 0·66 of oxygen. Furthermore, the phosphorus acts on the metal in such a way as to give it the various qualities necessary for its use in the arts, and its effect upon nickel may be compared with that of carbon upon iron. Thus up to three thousandths of phosphorus the nickel is soft and very malleable; beyond this amount its hardness increases at the expense of its malleability.

One of the means which I use to incorporate the phosphorus with the nickel is to add to the molten metal, in the desired proportion, a phosphide of nickel containing about six per cent of phosphorus. I obtain this phosphide by melting a mixture of phosphate of lime, silica, carbon, and nickel. This phosphide is white, hard, and brittle.

I have easily beaten out both cold and hot nickel containing 0·0025 of phosphorus, obtaining without difficulty sheets of two thousandths of an inch in thickness, that is to say, as thin as they could be made without beating out *en paquets*, and there is every reason to expect even better results. I have noticed that the first blow of the laminator brings out all the defects of an ingot, but that hardly any others show themselves during the remainder of the work, the reverse of what happens with *maillechort* (a kind of alloy resembling German silver); it is, therefore, very important to have ingots very free from defects.

Phosphorized nickel, united with brass, zinc, and iron, has given me results very greatly superior to those obtained with non-phosphorized nickel; the ingots were more perfect, since the phosphorus in absorbing the oxygen in the mass of the metal produced a solid and not gaseous compound. Thanks to phosphorus I have been able to unite nickel and iron in all proportions, always obtaining a soft and malleable alloy. This explains why some distinguished chemists have contradicted each other as to the malleability of nickel and iron united, some alleging that that alloy was brittle, and others that it was malleable; these latter used phosphorous iron.

Lake Superior Copper Mines.

The recent Lake Superior meeting of the American Institute of Mining Engineers brought out a considerable amount of interesting information touching the mineral resources of that wonderfully productive region.

The copper region of Lake Superior is divided into three districts, to wit: 1. Ontonagon; 2. Portage Lake; 3. Keweenaw Point. The Ontonagon district commences at a point in the neighborhood of twelve miles southwest of the shores of Portage Lake, while the Keweenaw Point district begins about four miles northeast of the Calumet and Hecla mine. The only productive fissure veins developed on Lake Superior so far are those that have been wrought in the Keweenaw Point district, at the Cliff, Phœnix, Central, and Copper Falls mines.

The industries mining on conglomerates are the Calumet and Hecla, Osceola, Allouez, and Ahmeek. Those on the amygdaloid deposits are the Quincy, Pewabic, Franklin, Hancock, Atlantic, Huron, Tecumseh, Osceola, Schoolcraft, and Concord.

The members of the Institute visited but one of these three copper districts—the second. Mining is being carried on at the following points north of the lake:

Hancock Mine.—Started in 1859. Working on amygdaloid deposit. Has produced up to December 31, 1879, about 1,400 tons of ingot copper. Local superintendent, John C. Ryan.

Quincy Mine.—In active operation about twenty years. Working on an amygdaloidal deposit. Deepest shaft, 2,000 feet. Dressing mill fitted up with the "cam" style of stamp heads, and Scheuermann's mineral dressers and Evan's slime table. Total production of ingot copper to December 31, 1879, about 25,000 tons. A. J. Corey, local superintendent.

Pewabic Mine.—Commenced regular work in 1858. Adjoins Quincy on the north and is mining on the same deposit. Deepest shaft, about 1,800 feet. Ball's stamps, and Collom's washers and Evan's slime tables in dressing mill. Has produced in the neighborhood of 11,000 tons of ingot copper up to December 31, 1879. Johnson Vivian, local superintendent.

Franklin Mine.—Started to produce regularly in 1859. Is adjacent to Pewabic, and is under the same local and Eastern management. Deepest shaft, 1,600 feet. The outfit in dressing works the same as the Pewabic. Yield from commencement to December 31, 1879, about 14,000 tons of ingot copper.

Concord Mine.—Started in 1866. At work on an amygdaloid on the northern prolongation of the Isle Royale series. So far has produced about 400 tons of ingot copper. Under same management as Franklin and Pewabic.

Osceola Mine.—Lies in line about eight miles northeast of the Franklin. Was started in 1873, mining on conglomerate and amygdaloid deposits. From commencement to December 31, 1879, has produced about 6,500 tons of ingot copper. Deepest shaft, 800 feet. Ball's stamps and Collom's washers and Evan's slime tables in dressing works, which are located on the shore of Portage Lake. The stamp rock is transported from the mine to the mill over the Mineral Range Railroad. John Daniell, local superintendent.

Calumet and Hecla Mine.—Borders on the Osceola. Active work commenced in 1866. Mining on a conglomerate belt. Deepest shaft, about 2,000 feet. Produced from commencement to December 31, 1879, in the neighborhood of 111,000 tons of ingot copper. Two stamp mills, each containing Ball's heads and Collom's washers. J. N. Wright, local superintendent.

The only mines on the south side of Portage Lake are the following:

Huron Mine.—Operated extensively first in 1863. Mining on an amygdaloidal lode in the Isle Royale, or eastern mineral series of this district. Deepest shaft, about 700 feet. The mine has afforded, since its commencement, over 4,000 tons of ingot copper. Johnson Vivian, local superintendent.

Grand Portage Mine.—Commenced in 1862. Mining on an amygdaloidal lode in the Isle Royale formation. Production to December 31, 1879, about 850 tons of ingot copper. C. F. Eschweiler, local superintendent.

Atlantic Mine.—(Formerly South Pewabic.) First worked in 1865. Lies over a mile to the southwest of Huron, in the course of the west formation of the district. Deepest shaft, over 800 feet. Dressing mill has in it Ball's heads, Collom's washers, and Evan's slime table. Total production of mine from commencement to December 31, 1879, about 8,000 tons of ingot copper. Wm. Tonkin, local superintendent.

The geology of this district, as described in the circular of the local committee, is as follows:

The trap range at Portage Lake has a width of over three miles, and is made up of a series of compact, granular, and amygdaloidal traps, with intercalations of sandstone and conglomerate, the whole having a strike of north 32° east and south 32° west, with a dip of from 38° to 56°, the highest angle of dip being near the southeastern boundary of the range, while toward the northwestern limit the rocks become more and more horizontal. Occurring both in course and in dip, with the rocks of the range are the copper lodes of the district, which present no features of mineral bearing fissures, being beds of amygdaloid trap and belts of conglomerate, the former carrying small masses and grains of native copper, while the copper in the latter is in small particles. Both deposits carry a little pure silver.

Supplementing this statement, Prof. W. H. Pettee, of Ann Arbor, Mich., described the modes of occurrence of the copper in the different districts. A northwest and southeast cross section of the peninsula at Portage Lake shows upon the southeast a considerable body of sandstone lying nearly horizontal, and not rising much above the general level of the lake. Next to the sandstone there is a series of beds having a northeasterly strike and a northwesterly dip. These beds, the number of which is very great, are partly conglomerates and partly amygdaloids, or traps, the latter being of volcanic origin. They are all conformable in stratification. Further to the northwest there is another series of sandstone beds similar to those on the southeast. The copper-bearing beds are confined to the amygdaloids and conglomerates. Whether the copper-bearing beds are older than the sandstones, or are of the same age, is a question which is still open for discussion. The key to the solution of the question is to be looked for along the line of junction between the sandstones and the traps. In Prof. Pumpelly's report it is stated that the rocks belong to two distinct periods, though some more recent examinations of the district point to the opposite conclusion. There is also a difference of opinion as to where the whole series belongs in the geological column, it having been assigned at different times to the Azoic, the Silurian, and even to the Triassic. At present the accepted view is that they are either Huronian or Lower Silurian, or form a series by themselves between the two just mentioned. Not all the beds of the copper-bearing series carry copper; neither is any one bed equally rich in all its parts.

Prof. R. C. Irving, of the State Geological Survey of Wisconsin, expressed the opinion that the copper-bearing rocks are older than the Potsdam sandstone. From evidences of non-conformity obtained in Wisconsin he was inclined to the opinion that the rocks of the copper region come between the Huronian and the Potsdam, the base of the Lower Silurian.

An Average Summer Rainfall

While the rainfall throughout the United States generally, from all reports, has been lighter during the summer months of this year than in years past, the fall in this vicinity, though very moderate, was heavier than in 1879. This is contrary to the general impression, which is that the fall here was exceedingly light. Data taken from the reports of the Signal Service officers with respect to the rainfalls during the months of June, July, and August for the last ten years, reveal some curious variations. The aggregate fall for these months in 1873 was very fair, yet in June only 1 29-100 of an inch fell. This is supposed to be the lightest monthly fall recorded anywhere in the United States in the past twenty years. The next lightest fall was in June, 1875, when 1 66-100 of an inch fell. As in 1873, however, the aggregate fall for the summer was good. The third lightest fall recorded was last August, when 1 69-100 of an inch fell.

The heaviest fall in the last ten years was in August, 1875, when 10 42-100 of an inch fell. The next heaviest fall was in July, 1872, the fall in that month having been 9 45-100 of an inch. The following table gives the exact amount of the falls in the summer months since 1871:

1871.	1872.	1873.	1874.	1875.	1876	1877.	1878.	1879.	1880.
7·14	2·94	1·29	2·87	1·66	2·87	3·31	2·91	3·42	4·40
3·60	9·45	4·15	3·22	5·23	5·72	3·86	5·26	3·39	6·67
5·48	6·13	7·68	2·53	10·42	2·97	2·54	7·30	5·17	1·69
16·22	18·52	13·12	8·62	17·31	11·56	9·71	15·47	11·98	12·76

—*New York Daily Graphic.*

New York's Summer Excursions.

The *Herald* devotes several columns to a review of the summer's work and receipts at the more popular resorts about this city. The summing up is as follows:

Resort.	Visitors.	Expenditures.
Coney Island	4,500,000	$8,775,000
Long Branch	400,000	1,800,000
Highlands, etc.	250,000	1,000,000
Rockaway	1,000,000	1,500,000
Long Beach	200,000	750,000
Glen Island	750,000	562,000
Fort Lee	750,000	375,000
Totals	7,950,000	$14,732,000

Nearly a million people paid for baths at the four bathing stations on Coney Island. Mr. John H. Starin, whose barges and steamers carry most of the excursionists to less prominent points, estimates that one and a half millions of dollars were spent on excursions alone to such places as Glen Alpine and points up the Hudson, and all of the chosen resorts of New York's people about Staten Island and beyond Hell Gate. If one were to go further, and add what has been spent at the races, in visits to picnic grounds, by rail and sailing craft, and the money spent in a hundred ways of pleasure seeking, of which no account can ever be had, it might be found that the 3,000,000 people who live in and around New York expended this year over $18,000,000 in keeping cool and enjoying themselves.

The Excavation of Flood Rock, Hell Gate.

The mining of Flood Rock, Hell Gate, in the East River at the northerly part of New York city, preparatory to blowing it up after the manner of the Hallett's Point work, is being pushed forward rapidly. The expenditure last year amounted to $140,000, and a large part of the $200,000 appropriated this year for the improvement of East River will go to this work. Employment is now given to 135 men, divided into three shifts of eight hours each. The central shaft is fifty feet deep.

Running across the river are twenty headings; at right angles to these are eleven cross headings, none of which have yet been extended their entire length. They average seven feet high and ten feet wide, and are situated about twenty feet apart. Near the main shaft, however, where more light and space are required for working, they are larger. Three acres have thus been undermined, or one-third of the whole. It is not intended to enlarge the headings until each one has been carried out to its full length. Then the chambers will be widened and made higher, so that the whole excavation will resemble an immense cave, the roof being supported by the rocky pillars which now form the sides of the headings. The thickness of the rock forming the roof will then be about ten feet, varying according to the character of the rock, whereas it is now from fifteen to thirty feet in thickness.

The work of tunneling proceeds very slowly, owing to the hardness of the rock of which the reef is composed. The rate at which it is now going on is from 500 to 600 feet a month, representing an excavation of about 1,500 cubic yards. It is impossible to tell when the whole will be accomplished at this rate. Frequently a seam is struck in blasting which stops the work in that heading altogether, on account of the leakage. In such a case it is customary to work around the leak. According to the last report, the work done during the past year was much greater than in any previous year; 24,000 cubic yards of rock were removed, 43,000 blasts made, and 57,066 drills sharpened. The number of blasts made each night now averages 150. The rock thus broken up is loaded on scows and dumped in the deep water to the south of the reef. Part of it was also used to fill up the space between Big and Little Mill Rocks, which lie to the north.

ON SOME IMPURITIES OF DRINKING WATERS.

Prof. W. G. Farlow, of Cambridge University, has recently distributed an interesting essay "On Some Impurities of Drinking Waters Caused by Vegetable Growths," and the object of which is to present in a popular form a statement of what is at present known in regard to the effect of the growth of different plants upon the water in the ponds, streams and basins which supply cities and towns. The subject is treated from a botanical standpoint—only certain striking properties, such as taste and smell, being considered, without taking into account those subtile changes which can be detected only by chemical analysis. The public are now beginning to read much about the "germ theory" of disease; and hearing that fevers may be produced by germs, and being told that germs are found in water, they naturally but illogically infer that any small bodies found in water are the germs of disease. There is no doubt that sensational writers have done much to spread alarm among all classes by representing as germs of disease such microscopic plants as Prof. Farlow treats of in his paper, but which could not possibly cause any of the diseases attributed by scientists to the influence of germs of a vegetable nature.

The most striking plants which grow in fresh water are those commonly known as "weeds," such as pond weed, pickerel weed, eel grass, etc. Flowering plants of this nature, in this latitude, belong to a comparatively few botanical genera. All of these weeds, whether they grow from the bottom, like those above mentioned, or float on the surface, like the small disk-like plants known as duck meats, may be considered harmless as far as any direct effect produced on drinking water is concerned. The only sources of trouble to be apprehended from them are (1) the mechanical one of choking up streams or bodies of shallow water; (2) that of serving as points of attachment or shelter for some of the minute injurious plants which the author next proceeds to consider, and which belong to that division of the flowerless plants known as algæ.

These plants are vastly more numerous than aquatic flowering plants, and are also much smaller—many of them being invisible to the naked eye. Some of them occur in the form of filaments; others form slimy masses of indefinite extent; and others consist of single microscopic cells floating in the water and only visible when they occur in immense numbers. Whatever their shape, however, we may, in considering their effects, divide them into two groups—those which are grass green or yellowish-green, and those which are bluish-green or purplish.

The first of these, botanically considered, belong to three different orders, but only two of these orders contain species which form masses of any considerable size. They frequent rather shallow places, and grow attached to sticks and stones at the bottom, or grow on the surface, where they form entangled masses several feet in extent. Considered from a sanitary point of view, Prof. Farlow states that these grass-green algæ have no injurious effect upon the water in which they grow. On the contrary, their presence may be regarded as an evidence of its purity, for they do not grow in impure water. They may, however, grow so luxuriantly as to fill up small bodies of water, and thus prove a nuisance.

The second, or bluish-green, group may, like the grass-green algæ, be in the form of filaments, expanded masses, or scums on the surface. They may also float freely in the water: but in this case they do not consist of single cells, but rather of aggregations of cells united by jelly into colonies. Their color, which is due to a mixture of chlorophyl and phycocyanin, is of importance, because by its means any one of ordinary intelligence can distinguish them from those above-mentioned. It is to the presence and decay of these bluish-green or purplish algæ that is to be ascribed the cause of some of the most decidedly disagreeable tastes and odors which frequently make their appearance in potable waters. These algæ are placed by botanists in a single order, which is divided into two sub-orders; but, to divest the subject of technicality, we may apply the term *Nostoc family* to the whole group. All of the species of this family flourish in hot weather, and form masses of large size. So long as they are living and not excessively abundant they produce no perceptibly bad effect on the water. When they decay, however, trouble begins: they give off then a jelly or slime which is often astonishing in amount; the phycocyanin exudes into and colors the jelly a light blue color, but which changes to yellow and then to brownish as putrefaction advances; and the slime gradually dissolves in the water, giving it a slightly oily or greasy consistency. When such putrefaction (which is quite rapid) takes places among large quantities of the plants it gives rise to the "pig-pen" odor, as it is called, which in recent years has caused considerable trouble and still more alarm in several cities of the United States. In connection herewith it should be stated that, as far as known, the so-called "cucumber taste" is not due to the growth or decay of any species of plant; and, as yet, no cause—chemical, zoological, or botanical—can be assigned for it.

The question as to the exact amount of harm caused by the excessive growth of *Nostocs* is to be answered by physicians and sanitarians. The water immediately affected becomes too offensive to drink, and cannot be entirely purified by filtration or by allowing it to stand; the only practical question is whether the disagreeable properties are conveyed any considerable distance. In one respect, says Prof. Farlow, the fears of the public may be set at rest. The theory that certain diseases, as fevers, are produced by germs of some low forms of plant life, whether true or not, has no bearing on the present case. On the one hand, although we know that the species above noted do cause the disagreeable "pig-pen odor," and do render the water affected unfit to drink, we know, on the other hand, that they do not cause the specific diseases whose origin is considered explainable by the "germ theory." The "germs," so-called, are all species of *bacteria*, distinct from the *Nostoc* family and much minuter. The public should receive with very great caution any statements about the dangerous effect of *bacteria* in our drinking waters; and, instead of worrying over the subject, had better leave the matter in the hands of scientists, who, at the present day, are the only persons who can be expected to follow the complicated and obscure relations of this difficult question.

The Model Workman.

The qualifications which constitute a model foreman being given in a recent issue, we copy what *Design and Work* has to say of shop honesty, energy, and judgment.

Honesty is as valuable in the workshop as in the counting house. That negative honesty which gives correct time on a job and scorns to take pecuniary advantage of an employer's mistakes is not meant; but the sound, old-fashioned honesty that reports a failure, or poor job, as well as acknowledges it when discovered. It is important that apprentices should form a character and acquire a reputation for honesty, a reputation that will be as good a recommendation as that of ability to do good work. Much of the annoyance of the foreman comes from the supposed necessity of watching the hands. They should require no watching. A reputation for telling the truth should be so strong that there will be no room for suspicion and no necessity for watching. It should be so strong that if a broken tool is found under the bench, or on the waste heap, the foreman can truthfully affirm: "This is none of Charlie's work, for he would have told of it; Charlie does not practice tricks."

The honest workman will not let a loose fitting stud pass, as he knows it may not only injure the reputation of his employers, but, like a diseased tooth, will be continually giving trouble, and must, at some time, come out. He will not peen around the edges of a poorly fitting joint to make it look tight, deceiving the foreman, and perhaps endangering the integrity of the machine. If the honest workman cracks a casting he will report it, even if the crack does not show, for he knows that, sooner or later, it may break, and the reputation of the concern for good honest work may be impaired.

Not only is the employer injured by the tricks of the dishonest workman, but his want of integrity makes necessary the cast-iron shop rules that are occasionally so irksome. These rasping rules are for the government of the dishonest, but they annoy also the honest workman. Almost every foreman has some men under him who require watching, men who will "sojer" when they have the opportunity, and who will "come Yankee" over their spoiled work unless they are watched. There are others who are shop honest, who will not "sojer" when the boss is out, who report their own mishaps promptly, who can be trusted at all times and under all circumstances, who do not dodge behind the lathes to wash their hands in oil five minutes before "shutting down," and drop under the bench pretending to be looking for something when the foreman comes. A sensible foreman could manage, easily, a regiment of these self-respecting men, who having no mean tricks have no necessity for evasion, and feel no fear of detection.

There is a valuable quality in workmen in a shop that is apt to be overrated by itself, which, combined with another, goes far toward making an excellent combination. Energy is frequently looked upon as the *ne plus ultra* of a workman, and it is stimulated by bustle, blow, and fuss, and these are frequently mistaken for the real thing. There is at least one man in every shop who makes a great stir about his work, and to a casual looker on is a very driving and valuable workman. But at the end of the week or month, or at the finish of a job, he does not appear to have accomplished any more than some steady, quiet worker who has made no particular display.

Energy drives his center punch into the end of a shaft for a center as a trial; but Judgment makes the center the first time. Energy places his piece in the chuck without unnecessary loss of time; but Judgment trues his piece before Energy has his right. Energy straps his work to the planer in a minute, and like Jack Horner with his pie, in Mother Goose, says, "What a smart boy am I," but perhaps he springs the work, and when the job comes from the planer it must be worked over for hours by the fitter before it is in proper shape. Judgment will be careful not to spring his work when he secures it to the planer platen, and generally it comes out all right. Energy may drill holes with great rapidity, but because they are not started right there will be more or less filing to do to make a fit. Judgment sees that the holes are started properly, and when he tries his plate over the studs it goes on without any file dressing of the holes. These parallels might be extended at length. Quick movements and bluster do not insure rapid work and productive energy. Many of the best workmen are deliberate in movement, but they never strike twice where one well-directed blow will do the work; they never make one crooked stroke with the file, requiring a dozen straight ones to remove its scratches; they never drill a hole too small for the tap and then wrench and strain to make the tap ream the way for the thread. The workman who combines judgment with energy does the right thing in the right way, and the results of his work count up more than those of the work of the driver and *blusterer*, whose work, supposed to be done, must be gone over and doctored.

These drivers are an annoyance to the foreman. It is very trying to his patience to find a job carelessly done when it was supposed to be all right; to have to square up here, file there, and finish in another place; to see that his confidence in the energy of the workman has been misplaced, and that the workman was making a show when he was pretending to do work.

The Pocket Handkerchief.

We may forget our purse, our penknife, and many other things, says the London *Hatter*, without experiencing any great inconvenience, and even without its being known at times, but to lose or mislay the handkerchief may be followed by very grave consequences, as we all know. Moreover, we make use of this article in many other different ways. All who make use of spectacles do not remove them from their nose in order to put them very carefully into the case without using the handkerchief, and they use it again before putting them on, wiping the glasses with great care. The majority of people pay by far too little attention to an object so indispensable. Many put it into the same pocket with their keys, their purse, their snuff box, without troubling themselves concerning the many strange substances with which its tissue will not fail to come in contact in so miscellaneous a company, and which might sully the purity which the handkerchief ought to possess. Does one go to pay a visit? Before presenting themselves to the person they wished to thank or solicit, some have been known to dust their boots with the handkerchief. Does the careful wife see some grains of dust left on her ornaments? She makes them disappear with her handkerchief. Boys in the school room clean their slates with them; in the playground the handkerchief is the necessary attendant of a multitude of games. With this they wipe off the dirt; they strike off the dust. It is used to stop the blood that flows from wounds—always very numerous in the age of leapfrog and prisoners' base; the age also of communism in handkerchiefs. With wounds come tears, and the handkerchief, full of dust, spotted with dirt, with the blood of bodies known or unknown, serves again for wiping the eyes, the nose, or the cheeks furrowed with tears. We do not wish, and we cannot tell here all the strange uses that people make of the pocket handkerchief. And then what signals have been conveyed by it! How many sad farewells, how many cheerful congratulations! The very method of waving it has a language, as the motions of the fan also have. But no one has hitherto discoursed on the language of the pocket handkerchief. And how useful it often is as a help to the pocket or the hand-bag! How many mushrooms, myrtle-berries, strawberries, and raspberries have been gathered into the handkerchief in young days, and more valuable things in later life! Then there may be evil results traced to it—a number of ailments of which one cannot guess the origin; diseases of the nose and eyes. Fortunate it is for him that incurs nothing worse; diphtheria, for example, which the handkerchief may heedlessly transmit. Let us not use the handkerchief except for its proper purpose; let us devote to it a special place; let us change it as often as possible, and inspire our children with a great disgust for another's handkerchief on account of the disagreeable, nay, dangerous consequences that may ensue. Much more might be said about the pocket handkerchief, but enough has been hinted at to set my readers a-thinking upon its importance, its uses, and its abuses.

Freezing Points of Fermented Liquids.

Mixtures of alcohol and water when subjected to very low temperatures congeal, but never completely solidify; the solid portion consists of pure ice, and can be separated from the alcohol by pressure. It has been suggested that dilute alcoholic liquids may be concentrated in this way, but we are not aware that the suggestion has yet been practically adopted. M. Raoult has determined the freezing points of various mixtures of alcohol and water, and has constructed a table which may be used for the determination of the strength of such mixtures. Without giving this in detail we may mention that his experiments show that in solutions containing from 0 gramme to 10 grammes of alcohol to 100 grammes of water, the addition of 1 gramme of alcohol lowers the freezing point by 0·377° C. (0·68° F.); in solutions containing from 24 to 51 grammes of alcohol to 100 grammes of water, the addition of 1 gramme of alcohol lowers the freezing point by 0·528° C. (0·95° F.). The same investigator has also determined the freezing points of various fermented liquors, which are always lower than pure alcoholic solutions of equal strength, in consequence of the presence of saccharine and other substances. The following table gives the determinations he has made:

	Per Cent Alcohol.	Freezing Point. C.	F.
Cider	4·8	—2·0°	28·4°
Beer	6·3	—2·8	27·0
Red vin ordinaire	6·8	—2·7	27·2
White vin ordinaire	7·0	—3·0	26·6
Beaujolais	10·3	—4·4	24·0
Red Bordeaux	11·8	—5·2	22·6
Red Burgundy	13·1	—5·7	21·7
Red Rousillon	15·2	—6·9	19·6
Marsala	20·7	—10·1	13·8

As with pure mixtures of alcohol and water, the solid matter which freezes out is pure ice, and can be removed by pressure, the remaining solution becomes in consequence richer in both alcohol and extract, and it has been suggested to use this method for concentrating worts and beer.

Business and Personal.

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

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

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

(1) F. S. S. asks: 1. Will a small (one or two man power) dynamo-electric run a lamp with sufficient quantity of light for projection purposes? A. Yes. 2. How would such a lamp compare with an oil lamp—what candle power? A. The power of the lamp will depend on its construction, on the efficiency of the dynamo, and on the power applied to it. The light, however, should be much stronger than that of an oil lamp. 3. Where and for about what cost can disks fit for condensers 4x3¼ be had? A. They may be procured from any manufacturing optician; the price we cannot quote. 4. Would emery wheel or grindstone rough them to shape more quickly? If emery, what grade? A. Sharp sand, used on a cast iron tool with plenty of water, is preferred by opticians for roughing.

(2) D. D. M. asks: Will a boiler in good condition, with two gauges of water, explode, no matter what the steam pressure is, or will it simply fracture at the weakest point? Please give what information in regard to boiler explosions you can. A. It will not "explode," in the strict technical sense, but will "burst," and do much damage. We refer you to the experiments of the Franklin Institute on boiler explosions, to "Robinson on Boiler Explosions," and to "Wilson on Steam Boilers."

(3) O. W. W. asks: 1. If a lump of lead was thrown into the deepest part of the ocean, would it sink to the bottom, or only go so far and float? A. It would sink. 2. What is the greatest depth ever actually sounded? A. 4,655 fathoms. 3. If a stout bottle of water, corked and sealed, is lowered into the sea to a great depth, will anything happen to it? A. The cork will be driven in or compressed, but as water is practically incompressible, nothing further will happen. 4. What is the strain on a rope with ten men on each end pulling in opposite directions? Is it the strength of 10 men or of 20? A. 10 men.

(4) J. R. S. asks: 1. What is the horse power of an engine 2 inches bore, 6 inches stroke, 250 revolutions a minute, and 80 lb. steam? I figure it a little over 1½. Am I right? A. You are right; but deducting 20 per cent for friction and losses, reduces it to 1½. 2. How many feet heating surface does the boiler require to have to furnish the amount of steam for two such engines working on the same shaft, the boiler to be upright flue boiler? A. 44 to 50 feet.

(5) F. B. D. writes: 1. I have a cell of Grenet battery, consisting of one zinc and two carbon plates, about 2x5 inches. I wish to make a single electro-magnet, or two single ones, to act alternately; what size of wire and core should I use? A. Use ¼ inch cores 2 inches long, and wind with 6 or 8 layers of No 22 wire. 2. Please tell me how to charge a gravity cell consisting of a zinc suspended at the top and a thin sheet of copper, about 1½ inch wide, bent around on the inside of the cell at the bottom? A. If the cell is of the usual size, place two pounds of sulphate of copper in the bottom of the jar. Suspend your zinc and fill with water so as to cover the zinc half an inch. Connect the poles, and let it stand for ten or twelve hours, when it will be ready for work.

COMMUNICATIONS RECEIVED.

On Preventing the Firing of Oil Tanks. By E. G. H.
With What Do We Think? By T. B. McC.
On a Remarkable Group of Sun Spots. By W. R. B.
On Cause of Perpetual Snow. By C. B.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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September 14, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

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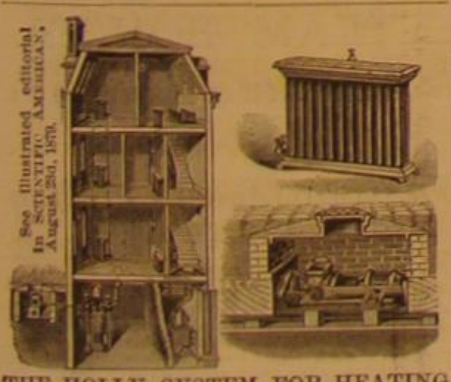

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