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OPTICAL TELEGRAPHY.

Men have, from the most remote epochs, endeavored to communicate with each other from great distances, and the first telegraphs were probably based upon optical signals. They were doubtless very imperfect, and could not be used for transmitting words, but they sufficed to announce in a general way that such or such an event had occurred. Upon reading ancient authors, we find that the Greeks and Romans lighted upon high mountains, or upon towers constructed for the purpose, fires which had a significance. It may be said with truth that in all times and among all peoples, even among savages, we find a trace of this idea.

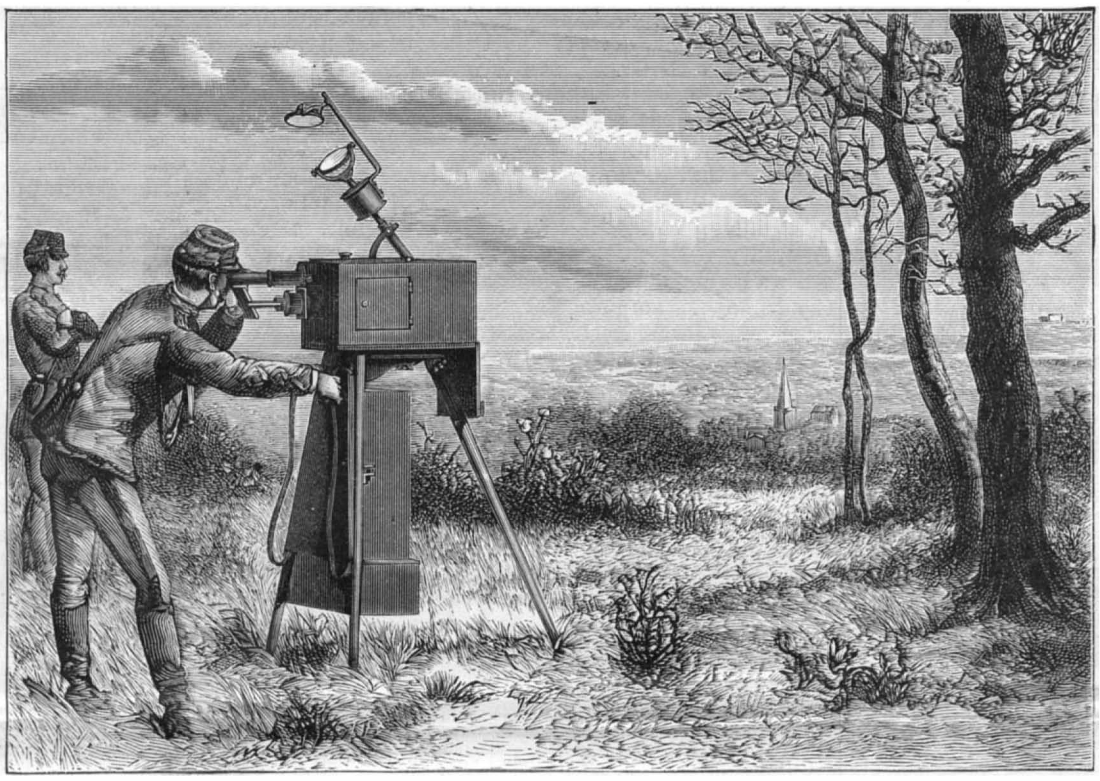

Fig. 1.—MILITARY OPTICAL TELEGRAPH WITH HELIOSTAT.

Toward the sixteenth century the system of corresponding to a distance seems to have been improved, and we find different proofs of experiments made in this direction. Since that epoch use has been made of opaque objects, such as wooden panels painted black or white, which, according to the way in which they are arranged, have various significations. This is the system now in use in the marine. As well known, in fact, vessels communicate with each other and with ports by means of flags by day and of lanterns by night, which, according to their relative positions, indicate certain numbers that correspond to those of an international code, in which there are about 80,000 phrases that can be used for communicating at sea.

Other systems, which perhaps would have proved very practical, have been proposed at different epochs, but have not been adopted, for the most part because they have not been carefully examined, or because the great advantage that could be derived from them has not been understood.

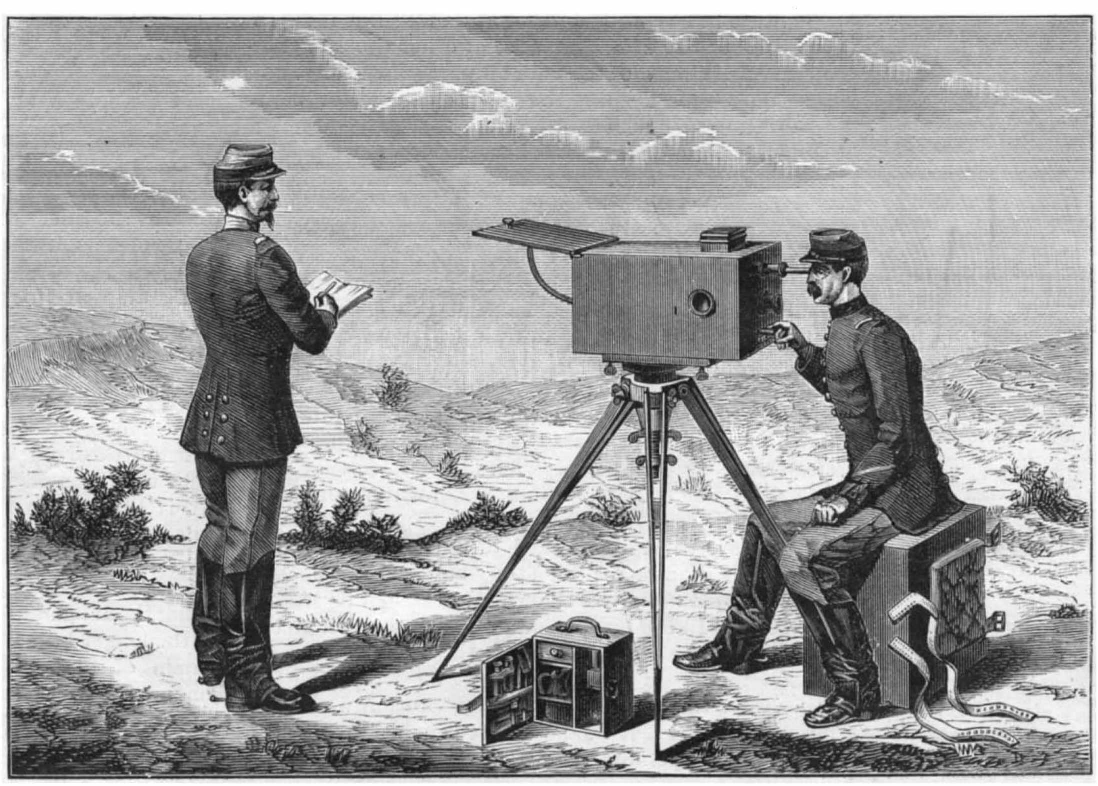

Fig. 2.—MILITARY OPTICAL TELEGRAPH WITHOUT HELIOSTAT.

It is to a Frenchman, Claude Chappe, that is due the honor of having invented and set up the first apparatus that were capable of being used practically for transmitting the usual alphabet, and consequently any dispatch whatever. This telegraph consisted of three strips of wood hinged to each other. The largest of these carried the other two at its extremities, and was attached by its center to the top of a mast situated upon an eminence. The different combinations that could be obtained by the relative positions of these three pieces were numerous enough to allow of a complete reproduction of the alphabet and of certain conventional signs. As every one has seen this system, if not in reality at least in engravings, we shall not dwell upon it.

The first dispatch was sent September 1, 1794, from Lille to Paris in a few hours. It announced to the Convention that the city of Conde had just been retaken from the Austrians. This was a good inauguration of so fine an invention.

The Chappe system remained in use till the invention of the electric telegraph, which gradually caused its predecessor to be abandoned, and even forgotten. It seems to have been used for the last time during the Crimean war, where it was employed as a field telegraph. After this, save in the case of a few applications, it entirely disappeared.

Optical transmissions, however, have, over electrical ones, an advantage that in certain cases must make them prevail, and that is that they require no wire or other material connection between the two stations. During the war of 1870, while Paris was invested and cut off from the entire world, regret was felt that the system had not been preserved and improved. The idea was taken up at this moment, but too late!

If, at this period, we had had at our disposal the simple apparatus that are now employed, and especially if their use had been better known, men certainly would have been found who, even placed in the midst of the enemy's lines, and at the risk of their life, would have endeavored, and successfully, to put the capital in communication with the rest of France. Every one will understand the immense advantages that could have been derived from such a result, when it is remembered with what anxiety the balloons and carrier pigeons were awaited on every hand, and with what enthusiasm they were received. So at this epoch the idea was taken up again. Many systems were proposed and tried, but time was wanting for the construction of the apparatus, the selection of stations, the instruction of operators, and it became necessary to abandon them. To-day the optical telegraph is sufficiently perfect, and is beginning to be used enough to allow us to hope that a like state of things shall not occur again.

Communications to a distance of 12 and 30 miles are easily enough established with simple apparatus, if time permits of it; and, in many cases, with an appropriate plant, enormous distances may be reached. Since the end of 1884, Mauritius and Bourbon Islands, 108 miles apart, have been thus connected by the persevering cares of Messrs. Adam and Dubuissen. The principle of the modern optical telegraph is based upon the emission of luminous rays for a certain length of time, according to the laws of the Morse alphabet. It consists, as well known, in combining dots and dashes that permit of representing all the letters of the alphabet and certain conventional signs. A very short flash corresponds to a dot, and a longer one to a dash.

The apparatus now used are of Col. Mangin's invention. There are two kinds of them, one of them light and particularly suited to field work, operating with lenses, and the other, heavier and more cumbersome, employed in fixed stations and in forts, and operating with mirrors or telescopes.

The lens apparatus (Fig. 3) consists of a sheet iron box, A B C, containing both the transmitter and receiver. The latter consists simply of a telescope, R, fixed to the upper left angle of the box. The transmitter is based upon the property that biconvex lenses possess of concentrating at a point called the *focus* the parallel luminous rays that reach them, and, conversely, of sending out a fascicle of parallel rays when a luminous source is placed in their focus. It is unnecessary to dwell upon this point, for who does not remember having amused himself in childhood in lighting spunk or paper by means of the rays of the sun concentrated by a lens?

At the back of the box, then, there is a biconvex lens, L L. The diameter to be given this varies with the power to be obtained. In the smallest model it is 5½ inches, and in the largest 15¾. In Fig. 3 it will be seen that alongside of it there is also placed a second lens, L' L'. The object of this arrangement is to diminish the focal distance, thus permitting of making the box shorter; but this in no wise changes the principle of the system. The luminous source is placed in the focus thus obtained. Up to the present, when the sun has not been employed, a kerosene lamp has given the best result. This is easily used, and its light is bright enough to be seen to a distance of 24 or 30 miles with 15¾ inch lenses, and, moreover, kerosene is now to be had everywhere. It is, then, an eminently practical luminous source for

(*Continued on page* 148.)

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NEW YORK, SATURDAY, SEPTEMBER 5, 1885.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 505,

For the Week Ending September 5, 1885.

Price 10 cents. For sale by all newsdealers.

THE METROPOLITAN WATER COMPANY'S PROPOSAL.

Some seven or eight years ago Mr. John Lockwood, hydraulic engineer, proposed what seemed at the time rather a startling scheme for introducing into the heart of New York a vast body of salt water to be used for putting out fires, and also for the highly sanitary purpose of flushing the sewers and thoroughly washing the streets. As the plan was decidedly novel, it took some time for people to thoroughly digest it, and considerable time before they became at all enthusiastic over it. It appealed very favorably, however, to Mr. William J. McAlpine, the civil engineer who built the Chicago Water Works, and his indorsement has done much to make the scheme popular. The enterprise has now been taken up by a corporation known as the "Metropolitan Water Company," under the presidency of Mr. Charles Spear, and it proposes to carry out Mr. Lockwood's plans as speedily as possible, provided a satisfactory arrangement can be made with the city authorities.

The territory to be included in the operations of the new corporation includes the entire island from the Battery to 59th Street, which means at the present time all the thickly settled portion of the city. At every point in this large area, it proposes to make an irresistible volume of water available at a moment's notice, so that anything like an extended conflagration, such as has visited Chicago and Boston, and even parts of New York, would be almost impossible. Such immunity from what is now an ever present danger is a large enterprise, and its accomplishment means the employment of powerful agents.

The main factor in Mr. Lockwood's plan is a massive tower of brick and stone, 100 feet in diameter and 350 feet in height above tide water. This is to be located about midway between the Battery and 59th Street, and Union Square has been mentioned as a suitable neighborhood. An alternative construction is a stand pipe 80 feet in diameter, and 350 feet in height, having a capacity of 12,000,000 gallons of water. This immense reservoir is to be kept filled with salt water from either the Hudson or East River, or both, by means of triplicate sets of pumping machinery having in the aggregate a capacity of 1,750 horse power. From the reservoir lines of pipe will radiate in all directions. These will vary in diameter from 8 to 20 inches, and will be connected by crosspipes of 10 to 36 inches every half mile. The hydrants will be ready for constant use, and will be so placed that no fire can occur at a distance from them of more than 490 feet. Twenty-eight hydrants could be brought to bear on any fire with hose varying in length from 100 to 500 feet in length, and as each has four openings, this would give 112 streams.

Using longer hose, but not exceeding 1,000 feet in length, 68 hydrants, or 272 steamers, could be made available. The head of water thus brought to bear against the flames will equal 300 to 350 feet, less the elevation of the locality above tide. Such a vast body of water would of course be needed only in time of widespread conflagration, but when such a need arose, it would be great enough to warrant almost any expenditure in having the water at hand. But it is proposed to utilize this abundance at other times in thoroughly washing the streets in all parts of the city, and consequently in flushing the sewers, salt water being an excellent disinfectant.

Such in brief is the plan of the Metropolitan people, and there is undoubtedly much to be said in its favor. The supply of water from the Croton is not abundant for so large a city as New York, and when it is diverted in any amount for fire necessities, the quantity available for domestic purposes becomes inconveniently small. Nor is its volume sufficient to cope with a conflagration of any size, and we are exposed at any moment to the danger of a devastating fire without the means for holding it in check.

The sanitary advantages of the plan are much to be commended, for besides the great comfort of a clean city, experience everywhere has shown that filth offers the best possible conditions for the spread of disease.

There are several practical objections to the plan, which will require careful study before it can be carried into operation, but these doubtless can be readily overcome. In the lower portions of the city, where the water would be under full head, the force of a stream several inches in diameter might be irresistible in other ways than fire extinguishing; caution would be necessary to prevent the large force evoked to fight the flames from spending itself in less desirable directions.

With a full reservoir, and making due allowance for friction of the water in the pipes, there would be many hydrants where the head of water would amount to 300 feet. This means a pressure of 10 atmospheres, or 150 pounds to the square inch, which would require good materials and careful workmanship to keep the system in order and make it effective.

The Metropolitan Company offers to furnish all the necessary plant at its own expense, provided that it gets a contract from the city for a definite term of years, and a specified price per annum for each hydrant. It is understood that no rental is to be paid until the work is completed, and the water ready for use. The proposal is still under discussion, and as yet no definite agreement has been reached.

SPEED ON THE OCEAN.

Quick passages across the ocean, such as those recently made by the Etruria, have little to commend them unless they are made in clear weather. Running at high speed in thick or foggy weather is both perilous and unlawful. The International Code of Rules to be observed at sea says distinctly that steamers must run at a "moderate" speed in thick or foggy weather, else they invite danger, not only to themselves, but also to the vessels which may be in their path. When it is remembered that one of these great ships while at full speed will run several miles before she can be brought to a full stop or turned a few degrees to the port or starboard, the absolute necessity for slow running in thick weather is obvious. None suffers so much from these fast trips as the brave fellows who man the great fleet which supplies the whole country with fish. The vessels of this fleet are always to be found lying at anchor or hove-to in the tempestuous seas which continually run across Georges and the Grand Banks.

It is dangerous work lying on these exposed banks at the best of times, for the holding-ground, being shifting sands, is bad, the seas high, and especially in the winter season the winds are fierce. But add to these dangers the continual passing to and fro of a fleet of fast-going ships bent on making time, and the chances of disaster are greatly increased. Rarely a season passes that one or more of these fishing vessels, carrying from 15 to 20 men, are not cut down by the iron prows of the transatlantic liners, and a score of families in the Gloucester hills put in mourning.

The heartlessness exhibited at times by the masters of some of these ocean "greyhounds" would be incredible, were it not corroborated as well as it is. One of these ponderous iron ships can cut down a fishing schooner of fifty tons without awakening its sleeping passengers. A slight shock passes through the ship, and all is over. If the gale is blowing, the shouts of the fishermen, struggling in the water, will not be heard below the main deck, and even then only for an instant as the great ship rushes by. Sometimes, so the fishermen say, the commander will stop his ship, and sometimes he will not. Under the usual conditions of weather obtaining on the Banks, it makes little difference whether he does or not. For one of these ships when at full speed will, as said before, run several miles ere she can be brought to a full stop, and before the boats can be launched and sent back it is usually too late; the men in the water having gone down, or been lost to sight in the rolling seas.

Article 18th of the International Code says: "Every steamship when approaching another ship so as to involve risk of collision shall slacken her speed, or stop and reverse if necessary." In these and all other rules to be observed at sea, there is a clause which warns masters of steamers to run slowly, or even stop and blow their whistles, when in thick weather and in a vicinity where usually many vessels are to be found. Hence when the masters of the so called ocean greyhounds run at full speed over the Banks in thick weather, they willfully disobey the law, and wantonly imperil the lives of the fishermen.

There is another side to this, and one that directly concerns the safety of the passengers themselves. The danger of encountering icebergs in the spring and summer upon the ocean highways is always more or less imminent, and this danger increases as the speed of the ship. The thermometer furnishes a fair warning to a trained eye of the vicinity of icebergs *when they are to windward* of the ship, that is, when the wind is blowing from the ice toward the ship; but when they are dead to leeward, the thermometer has been shown to furnish little or no warning whatever, and to be little better than useless.

It is but fair to say for the Cunard Company, the owner of the Etruria, that for a long time it held itself aloof, and maintained the reliable and conservative course of making safe rather than quick passages; reducing the dangers of the Banks to a minimum by adopting the longer but far safer course to the south of this domain of fogs, icebergs, and fishermen. But the demand for quick passages grew apace; the swift-footed ships of rival lines were eagerly sought after by the general public, and quarters in these for the passage commanded high figures. This brought on an attack of the quick-passage fever of the most virulent type; the old and safer Cunard Company exchanged the longer but safe passage for the shorter one over the Banks, bought the Oregon, built the Aurania, Umbria, and Etruria, and is now apparently outstripping its rivals in the very course which heretofore it so strenuously condemned.

FARADAY proved the magnetic condition of all matter, and that magnetism, unlike electricity, cannot be insulated.

A. S. LYMAN.

For more than a third of a century the name of Azel Storrs Lyman, who died in Brooklyn, N. Y., Aug. 26, has been a prominent one among American inventors. He was born at Potsdam, N. Y., in 1815, and was of the eighth generation of the descendants of Richard Lyman, who came to New England in 1629. He was educated at the Illinois University, and began the study of the ministry, which he was obliged to relinquish on account of incurable deafness, a physical affliction to which was probably due the fact of his devoting the remainder of his life to the long list of inventions with which his name is connected.

He was one of the first in the field in making fountain pens, having obtained a patent on the holders and nibs in 1848; then came a patent alarm for indicating the want of water in steam boilers, followed by a water gauge; next he had an air engine, on which and on air pumps he made several subsequent improvements. In 1856 he obtained a patent on a method of cooling and ventilating rooms, several subsequent improvements in a similar line in following years being the subject of different patents, one of which was a most simple but ingenious invalid's bed for fever patients; the idea of this was simply to have an ice holder above and back of the head of the bed, from which a passage led to just above the patient's forehead, thus providing for a steady flow of cold air thereon, according to the natural law by which the colder air of a room seeks the lower levels.

In 1857 he began to develop his ideas of an accelerating gun, which was the subject of many succeeding patents, the principles of which have been fully illustrated and described in the SCIENTIFIC AMERICAN; the last of his developments in this chain of ideas seem to have been represented in his three patents on gunnery and an accelerating cartridge, obtained in June last, when the deceased was in his seventy-first year.

The manufacture of paper pulp from wood fiber early claimed his attention, and he obtained a patent on a method of separating the fiber of wood in 1858, which was followed by several subsequent ones for this purpose, as well as for utilizing straw and other fibrous substances, the recovery of spent alkali, and other important details of the paper manufacture. His "fiber gun" was made with long iron cylinders, which might not inaptly be compared with the guns of an army battery; into this prepared cane or wood was put, and kept for a few minutes under a steam pressure of about 200 pounds, after which, by pulling a trigger, a cover was suddenly unfastened, and the contents discharged against a target several feet distant, thus effecting more in fifteen minutes in disintegrating the fiber than was accomplished in many hours' work before.

The many other inventions of Mr. Lyman, which we will not refer to in detail, included a refrigerating car, several methods of preserving meat and vegetables, and for separating gelatine and meat from bones, and rendering lard and tallow, cans for preserving food, and soldering apparatus, apparatus for concentrating milk, a rotary engine, etc. His lines of thought and application were almost exclusively in the field of natural philosophy, the elementary principles of which he was always endeavoring to employ in some new and practical way, to simplify and improve on what had theretofore been done in the various departments to which his attention was directed.

Casting and Forging.

A very general misapprehension exists in regard to the value of cast iron articles and the same description of articles forged from wrought iron. There is a mistaken idea, also, that it is less expensive to cast than to forge. This error is not confined to the unmechanical public, but is shared by many mechanics; perhaps the possibilities and facilities of drop forging are not sufficiently understood; but it is true that many articles can be drop forged from tough wrought iron cheaper than they can be cast from brittle cast iron. The range of purely cast iron work is great—from a single casting of thirty or more tons to pieces that weigh less than a quarter of an ounce—and its cost varies from a price barely above that of the pig iron delivered to sixteen, eighteen, and even twenty cents a pound. But many small articles are cheaper forged than cast, and almost immeasurably superior. The cost and value of the forgings give them a superiority over the castings, especially when one pattern is required in large numbers. For each single casting or plate of castings a new mould is required; moulding costs money and requires judgment if not exact skill, and even with the mechanical appliances for bench moulding the losses from defective castings are very great. But in drop forging the mould—dies—will do for hundreds, thousands, of pieces, and the percentage of loss by imperfection of work is very slight. Nor does plain drop forging require the highest grade of mechanical skill.

There are many small articles of common use in the market—some of them coming under the designation of tools—which, from a mistaken notion of cheap production and low price, are made from cast iron or from cast iron made malleable. Many of these could have been made from wrought iron, or at least from machinery steel, and sold at the same price for as large a profit; or with a few cents added to the price could have been sold at a greater profit. When cast iron thumbscrews with quarter inch shanks are put upon the market the folly of cast iron must have reached its limit.

The Tehuantepec Ship Railway.

Mr. E. L. Corthell, C.E., lately delivered a very interesting address on this subject before the American Association for the Advancement of Science, Ann Arbor, Mich., from which we extract the following:

Assuming it practicable to make the crossing at Tehuantepec, no one will question the assertion that it is much the most advantageous route. Its great commercial advantages are evident from two facts: *First*, it lies nearer the axial line of productions, which may be assumed as passing through Hong Kong, San Francisco, New York, and Liverpool. *Second*, the nautical conditions are much more favorable that at the other locations, calms and baffling winds prevailing on either side of the Isthmus near its southern end, making it almost impossible for sailing vessels to navigate in those waters.

The true scientific method is that one which performs the work of transferring ships from one ocean to the other most promptly and most economically. This method is the *ship railway*.

This method is, in general, to lift the vessel from the water by well known means, and transport it 134 miles over the country, and place it in the opposite ocean by the same means. The details embrace a lifting dock, with a system of the hydraulic rams, so arranged as to hold up and perfectly distribute the weight of the vessel, and a system of carriage supports conforming to the position of the rams and actuated by them, so as to be placed under the hull of the vessel.

The roadbed will be built of the best materials at hand, which the surveys show can be found on the whole length of the railway. The superstructure will be long steel ties, on which will be laid heavy steel rails, weighing about 100 pounds per lineal yard. Powerful locomotives will haul the ships across the Isthmus. The locomotives built recently by the Baldwin Works are sufficiently powerful to do this work. These engines weigh, when ready for service, 102 net tons, and their capacity is 3,600 *gross tons* on a level. Three of these will haul the maximum load of 5,650 tons at 15 miles an hour on grades up to 20 feet to the mile.

The railway follows a succession of broad valleys, so that it is often necessary to make changes of direction to avoid the heavy excavations that would be required by employing the ship railway curves of twenty miles radius. These abrupt changes of direction are made by great floating turntables, which float in segmental basins around a central pivot, though they do not rest on anything but the water, which is pumped into the surrounding basin from the turntable to give it flotation.

The harbors, both on the Gulf and on the Pacific, are excellent and commodious, and the entrances to them can be deepened with small expense.

The large number of practical experts who have carefully examined the plans have given unequivocal testimony to the entire practicability of the method, and also to its economy.

This is not the only ship railway that has been projected. They have been designed for Honduras, Egypt, and Nova Scotia. The time has passed when it is necessary to prove to practical men the feasibility of the ship railway method, therefore the next important subject is taken up more in detail, viz., the *superior economy* of the ship railway over the ship canal, both in construction and operation.

The history of canal and rail transportation, going back to the earliest days of railways, shows how quickly the latter took the lead in every respect, economy as well as dispatch.

Experience and experiments both in this country and England are found in abundance to prove this.

If we compare ship canals and ship railways, we find a greater difference in favor of the latter. The restricted channel in which the ship moves in a canal is the cause of the greater expense required to push the vessel through the water. The boat or ship practically creates a hill up which she is continually climbing; the faster she is urged through the water, the steeper is the hill and the greater is the power required, which increases as the *cube* of the *velocities*.

An historical examination of the actual cost of moving freight by canal and by railroad shows that the latter is far in advance of the former in economy, and if the time lost on the canal is taken into account, there is still a greater difference.

Some of the more important details of the comparison are here given. The constant improvements in railroad transportation have reduced the cost of *hauling* to 6-10 mill per ton per mile.

The load has increased from 20,000 pounds to 60,000 pounds in the last ten years, while the weight of cars has only increased 2,000 pounds. The increase of capacity in cars and power of locomotives, the introduction of steel rails and better system in operation, are the principal causes of the cheap and effective transportation of the present day.

Now, carry out these tendencies to their legitimate extent, as they will be in the ship railway; instead of 15 tons the average, or 30 tons the maximum, moving on *two* rails, put on 1,800 tons, moving on *six* rails, and then, with great concentrated motive power, the freight will be hauled for *two-tenths of a mill* per ton.

Then compare speeds; *two miles* on barge canals is the economical and average speed, *one mile* per hour on ship canals is the customary speed, and not over two miles on the Suez canal.

On railroads it is 15 to 20 miles, and on the ship railway 10 miles. The relative cost of transporting a ton of freight on a canal by steamer and in the free waterway of the ocean is as *six* to *one*. The total cost of *docking* and *hauling* from ocean to ocean on the Ship Railway will be 12 *cents*, but the cost of steaming through the Nicaragua canal will be 60 *cents*.

The immense cost of construction and maintenance of the canals excavated, as the Panama is, below sea level, through a country of excessive rainfall; the long detour required for commerce; the instability of the governments and people through which they pass—these are some of the objections to the canals.

The *strategic* advantages of the ship railway are very important. Mexico and the United States together can protect the railway against any foreign powers. Our navy can hold the approaches to the Gulf; there is a capacious and protected harbor in the Coatzacoalcos on the Gulf and one in Lake Superior on the Pacific, and the railroads leading into Mexico from the United States could quickly concentrate a large army at the Isthmus.

7,000,000 tons of freight are in sight for transportation over the railway in 1889. The railway can be built and equipped in four years' time. $50,000,000 in cash will complete everything ready for business. The estimate in stock and bonds, allowing for all possible contingencies, is $75,000,000.

Even with only 4,000,000 tons, the net profit would be 14½ per cent. The beneficial results cannot be overestimated.

Industry, commerce, society, and religion, in fact in all his relations, will man be benefited.

The success of the projector of the ship railway in his other important works—ironclads during the war, the magnificent bridge at St. Louis, the Mississippi Jetties, and other works, gives standing to this new work, and leads to confidence in the ability of Mr. Eads to carry it through to a successful conclusion.

The address, printed in full, is illustrated by plates of the plans and by maps of the world and the Isthmus.

The Pacific Mills.

The Pacific Mills, situate at Lawrence, Mass., are reported to be the largest textile manufacturing corporation in the world. The capital stock is $2,500,000. The number of the mills and buildings is 23, covering 43 acres of space; there are in use in these mills four large steam engines, of 3,500 horse power; 42 small steam engines; 50 steam boilers; and 11 turbine wheels, of 5,000 horse power. The annual consumption of coal is 25,000 tons; the annual consumption of gas, in 9,000 burners, costs $35,000; the annual consumption of cotton is 15,000 bales; the annual consumption of wool is 4,000,000 pounds, being the product of 750,000 sheep. The annual capacity of the Pacific Mills is, in cottons, printed and dyed, 65,000,000 yards; worsted goods, 35,000,000 yards, or a total of 100,000,000 yards, equal to two and a quarter times the distance round the world. To make this cloth, nearly 200,000,000 miles of yarn are required. To accomplish this work, 3,600 females and 1,900 males, or a total of 5,500 persons, are employed. The pay roll for the year ending May, 1884, amounted to $1,790,000.

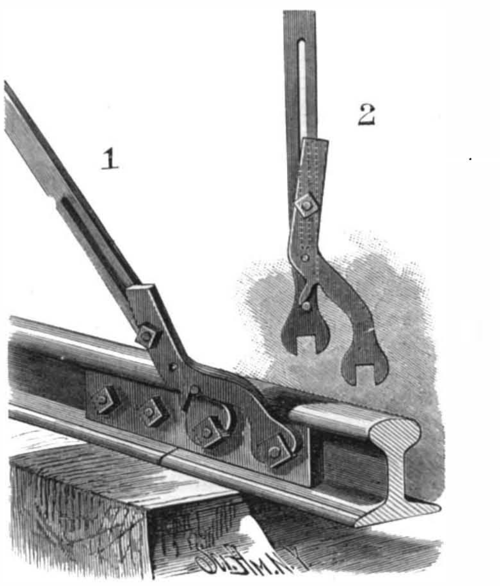
The North, Central, and South American Exposition.

Almost simultaneously with the decision to terminate the World's Industrial and Cotton Centennial at the announced time, the 31st of May last, there was formed an entirely new organization under the title of the North, Central, and South American Exposition, which proposes to open another exhibition at New Orleans during the coming fall and winter. Its leading object will be to bring into closer commercial relations the peoples of the three Americas, and, if possible, to divert a larger portion of the rapidly increasing trade with the southern countries to our own ports, instead of letting it pass our doors for the longer journey to European marts. The total imports of Mexico, Central, and South America, and the West Indies, amount annually to $475,000,000, only 16 per cent of which is supplied by the United States. Of the exports of those countries, of about equal value, we receive 36 per cent.

The new organization has purchased the entire buildings and plant of the World's Exposition at a low figure, and therefore starts out under very favorable circumstances. The President, Mr. S. B. McConnico, is supported by a Board of Managers representing all sections of the country. The Exposition opens Nov. 10, 1885, and closes March 31, 1886.

AN IMPROVED LEVER WRENCH.

A wrench especially designed for turning the nuts on fishplates is shown herewith, Fig. 1 representing the wrench as applied on the rail, and Fig. 2 giving a side view. It is so constructed, it will be seen, as to turn two nuts at the same time. The main lever bar has a slot, and on the lower end a squared recess for receiving the nut; from this bar also projects a stud or pin, and a bolt through the slot holds another lever bar, curved as shown, and having on its lower end a squared



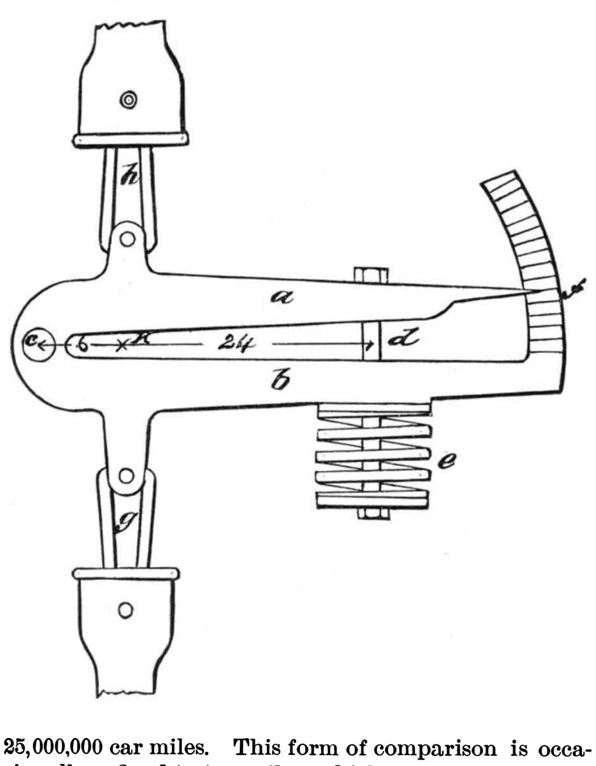
GOODSON'S WRENCH.

recess for receiving another nut. This second lever bar has a downwardly projecting lug, to engage the stud or pin on the main bar, and regulate the distance the second lever bar is allowed to drop. In operation, as the main lever bar is pushed forward, the bolt attaching the second lever bar slides upward in the slot, and two nuts are thus turned at once.

This invention has been patented by Mr. William D. Goodson, of Eufaula, Ala.

PERFORMANCE SHEETS AND RECORDING WORK DONE BY LOCOMOTIVES.

It is generally the opinion now among railroad men that the exchange of "performance sheets" is of no value. This arises from the fact that the conditions vary very materially under which these sheets are made up, and it follows, therefore, that a master mechanic who may be operating his locomotives at a total cost of 17 cents per mile is really doing this cheaper than another who is operating at 12 cents per mile. The standard of comparison of work done is the *loaded car*, or loaded car miles, which means the number of loaded cars hauled one mile. This is obtained by multiplying the number of loaded cars hauled by the number of miles they are hauled, the result being loaded car miles. Thus 500 loaded cars, each hauled 100 miles, is a mileage of 50,000 miles, and 500 × 50,000 =



25,000,000 car miles. This form of comparison is occasionally refined to ton miles, which means the product of the weight of the cars and loads hauled in tons by the total mileage. The want of any truth or value in the comparison of the performance of engines on different roads is found in the fact that a "loaded car" may mean a load of 12, 13, 15, 17, or 20 tons. Then in the rating of empty cars, that is in reducing a mixed train of "loads" and "empties" to "loads," the same want of uniformity is found in a standard of measurement, as one road rates three empty cars as one loaded one; other roads say five empty cars equal three "loads," or two "loads;" others, seven "empties" as three or four "loads," and thus it will be seen that a comparison on such data is worthless.

This might be refined, as before mentioned, by reducing the trains hauled to ton miles, that is, taking the weight of the train in tons (thus eliminating the factor of "empties" and "loads"), and multiplying it by the miles.

But while this result is a little nearer the truth than the other, it is not what is required, as no comparison or data is furnished of the extra work expended in hauling up grades and around curves, as it is plain that one road may be an extreme in hills and curves, while another, with which comparison is made, is as level and straight as could be wished for.

It is occasionally claimed that a hilly road is no more costly to haul over than a level road, and theoretically this may be true. But in practice there is quite a large difference, which arises from the fact that an engine slips more on a hill than level, and the loss of stored-up work in the train, obtained by hauling the train up the hill, which work is not given out to any useful end in descending the hill, as the speed of the train is controlled by the brakes, and the surplus of this stored-up work is thus ground away in uselessness against the brake shoes.

To gain or profit by the stored-up work, the train would have to be allowed to run down the hill unchecked by the brakes, a proceeding of a character which would hardly pay for the profit, in view of the dangers, etc.

The only correct basis or standard of comparison would be the foot pounds of work done in hauling a train over any road. To obtain this, the average strain on the tender drawbar would have to be obtained (unless it was desired to include the work of moving the engine). Knowing the average pull on the drawbar and the weight of the train, and assuming an average freight train speed for all roads of 15 miles per hour, and the necessary factors are at hand to make a fair comparison. To obtain this, a train of known weight might be hauled over a road at 15 miles per hour with a dynamometer placed between the train and engine, and its reading taken every one, two, or three minutes, and the average strain in pounds per ton of the load thus obtained. This would take into account all hills, curves, etc. A rude but practical dynamometer for this purpose, which the writer has used, is shown in the accompanying illustration.

Two bars of iron pivoted or hinged at C are arranged with lugs to be coupled by a link between the engine and tender at *h* and *g*. The extension of arm, *a*, forms a pointer moving over the arc, *f*, which is an extension of arm, *b*. A crucible steel car spring, *e*, abutting against arm, *b*, is attached by a bolt, *d*, to arm, *a*, so that when the arms are drawn apart by the pull of the engine, the spring will be compressed. As such a rig is necessarily home-made, the location of the spring, *e*, is dependent on its size, etc.

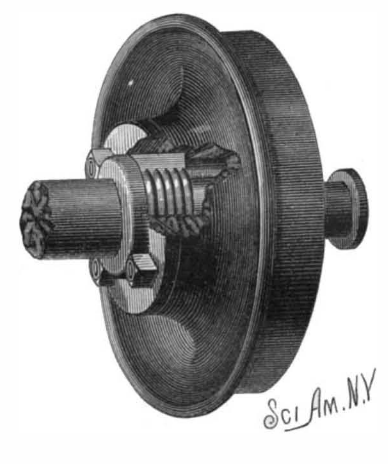
A crucible steel spring that has had use enough under a car to work out the tendency to "set" in new springs is the best. The spring must be capable of resisting, just before it closes completely, the entire pull of the engine. Supposing the average freight engine to be able to be exert a pull of 12,000 on the drawbar, and the distance from the center of the line of draught, K, to the center of the pin, C, pivoting the arms together to be 6 inches, and the distance from K to the center of the bolt, B, to be 24 inches, then to find the resistance a spring must offer to be equal, when almost closed, to a pull of 12,000 pounds at *h*, we have $\frac{6 \times 12{,}000}{30} = 2{,}400$ pounds.

Springs can be readily tested in a wheel press, or with a lever arranged across the top of the spring and weighted at its outer end. If a spring is found which nearly closes at more or less than this weight, its location or distance may be easily found to balance the supposed pull of 12,000 pounds on the drawbar by multiplying the 12,000 by the distance from the center like of draught, K, to the point, C, and dividing the product by the number of pounds the spring nearly closes at, the result being the distance in inches the spring is to be located at from the center of C. To use such a rig, it is necessary to extend the dead woods so that the extra slack given by the rig may not be injurious. After locating the spring, the arm, *f*, may be marked by suspending the rig from a suitable support, such as a heavy crane, and either loading the lower end, *h*, with car wheels of known weight, or arranging a lever to pull down at *h*, so that less material in weights will be necessary. Hitching a given number of cars of known weight behind the engine, with this rig, and keeping an even average speed of 15 miles per hour, and reading the indication as the arc, *f*, every one or two minutes, or half or whole miles, would give data for an average pull per ton for that road. This being once known, the work done by an engine in hauling any train, whether of loaded or light cars, would be easily arrived at, and justice done to many master mechanics, whose apparently high cost per mile run would be explained by the fact that from three to five times as much work was performed by his engines.

FRANK C. SMITH.

A CAR WHEEL AND AXLE.

To afford improved means of attaching car and other wheels firmly to their axles, and so the wheel can be readily removed if desired, is the object of an invention recently patented by Mr. Joseph H. Black, of Columbia, Penn. The axle is formed with an enlarged screw-threaded collar, which is slotted to receive a key, while the wheel has a screw-threaded recess to receive the screw-threaded collar, and is slotted to correspond with the slot of the collar of the axle, to receive the key for fastening the wheel upon the axle. To strengthen the wheel, and to hold the key in place, semicircular washers are bolted to the wheel by screw bolts passing through the wheel and washers. To simplify the drawing out of the key, in case the wheel is to be removed from the axle, a passage is formed through the wheel in line with the recess occupied by the key, in which a small tool may be inserted for driving back the key.

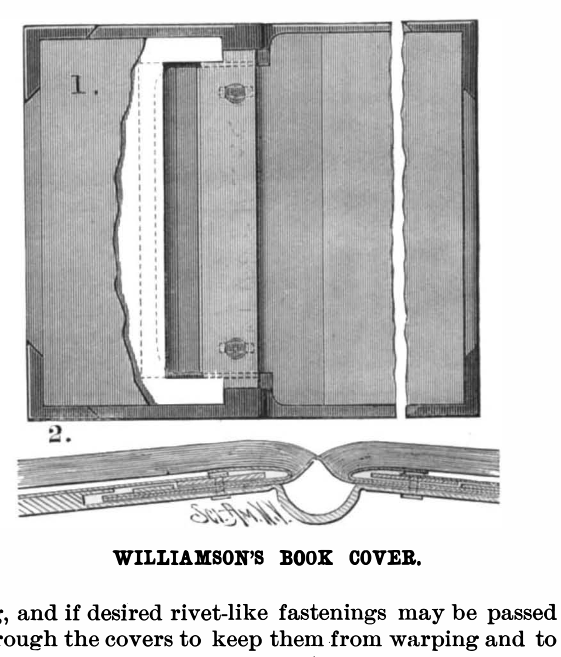


Strange but True.

This is one of the curious things floating about: Take a piece of paper, and upon it put in figures your age in years, dropping months, weeks, and days. Multiply it by two; then add to the result obtained the figures 3,768; add two, and then divide by two. Subtract from the result obtained the number of your years on earth, and see if you do not obtain figures that you will not be likely to forget.

AN IMPROVED COVER FOR LARGE BOOKS.

Usually in opening large blankbooks, and other heavy volumes, bound in boards and with stiff backs, the first few sheets are drawn back with the cover, causing strain on the threads, to obviate which difficulty is the object of the invention herewith illustrated. Fig. 1 represents a partly broken inside view of a book bound according to the new plan, and Fig. 2 a transverse section of the book open in the middle. The book proper or leaf portion is stitched and strapped together in the usual manner, but attached to the stitched portion is a stiff, or moderately stiff, slide or sliding flap, on each of its two outer sides, these slides being fitted to work freely back and forth, when the book is opened and closed, within recesses in the bound covers, these recesses extending any desired distance into the covers from their inner edges, and to within a suitable distance from the end edges. Suitable stops are provided for these slides, to limit their movement and prevent the separation of the book and its covers, one form of which is shown as a face strip arranged to work with the slides in a suitable longitudinal open-



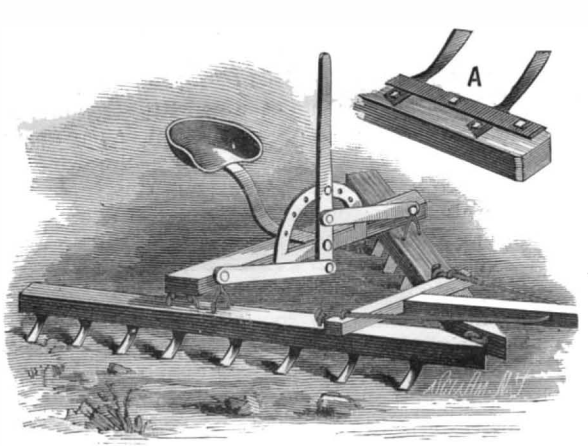
WILLIAMSON'S BOOK COVER.

ing, and if desired rivet-like fastenings may be passed through the covers to keep them from warping and to prevent the slides from being torn out. By this method of binding a sliding joint is formed at the connection of the book with the covers, so the book may be opened freely and flat without straining on the threads or binding.

This invention has been patented by Mr. Thomas F. Williamson, of No. 180 Twenty-fourth Place, Chicago, Ill.

A SOD CUTTER AND PULVERIZER.

The invention herewith illustrated provides a simple and effective machine for cutting in pieces sods and pulverizing hard or baked soil. The inclined side bars and the cross bar are hinged to each other, and carry bent and twisted knives, adjusting bars, and a hinged tongue. The manner in which the knives are attached to the side bars is shown at A, where a rear part of one of the side bars is shown inverted. On the front of the cross bar, to which is attached a spring standard carrying the seat, is pivoted a lever, moving along an arched catch bar, and connected with two bars hinged at their outer ends to the side bars; by operating this lever the driver can turn the side bars upon their hinges to cause the knives to worker deeper or shallower in the



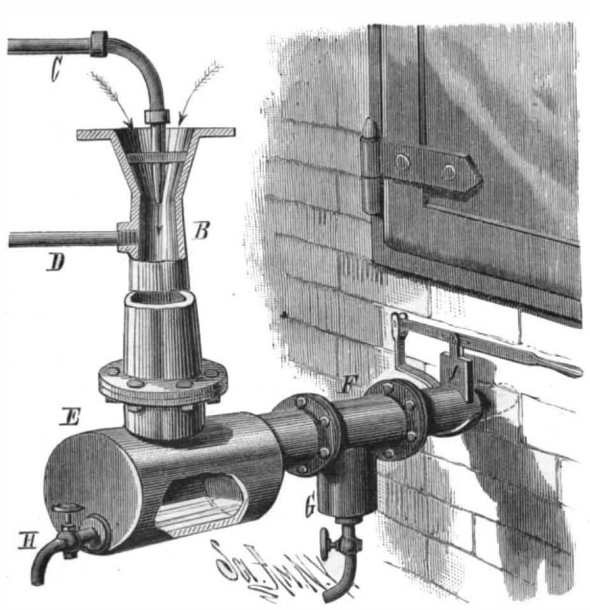
PHILLIPS' SOD CUTTER AND PULVERIZER.

ground, and this lever will be held by a pin or catch in any position at which it may be adjusted.

This invention has been patented by Mr. James R. Phillips, of Webster, Day County, Dakota Territory.

A MOIST AIR INJECTOR FOR FURNACES AND FORGES.

This injector is for supplying furnaces with air mingled with steam or moisture, to facilitate combustion, to protect the furnace or forge, and desulphurize the metal under treatment. The invention is an improvement on a former patented invention of the same inventors, and consists in novel combinations of water chambers and a water supply pipe with the air pipe and steam jet pipe discharging therein, which will be readily understood from the accompanying illustration. The air enters the pipe or trunk, B, around the nozzle of the steam inlet pipe, C, and is carried along by the pressure induced by the steam jet; the pipe, D, also discharges a regulated quantity of water opposite the nozzle of the steam jet, so that the air, steam, and water fall together into the chamber, E, in the bottom of which is a body of water, a pipe, F, leading out of the chamber, E, above the level of the water in its bottom to the place of discharge inside the furnace or forge. This pipe, F, has a pendent chamber or pocket, with a drain pipe or faucet, G, and the chamber, E, has also a valve, H, so that there will be no excess of water in either place to be taken over with the air into the furnace. At the point where the nozzle enters the furnace there is a gate valve to regulate the supply of air as may be desired. By this



DAVIS & WALKER'S MOIST AIR INJECTOR FOR FURNACES AND FORGES.

arrangement it is claimed that the proper amount of moisture is better obtained and the steam more easily condensed than was formerly accomplished by the water jacket or box surrounding the discharge nozzle of the air pipe, and that much less water is required for the purpose.

This invention has been patented by Messrs. John B. Davis and William Walker, of Jermyn, Lackawanna County, Pa.

Hardening Plaster.

The *Journal du Ceramiste et du Chaufournier* describes a new method of hardening plaster of Paris; from it the following extract is made:

In 1878 and 1880 M. J. B. Mallion, of Lyons, made a number of experiments in the hardening of plaster from Piedmont. He first tried a mixture of plaster and fat lime; but the result was unsatisfactory, the object remaining granular and of a dubious color. He then experimented with the magnesites simply made caustic; his success was complete, the magnesia hardened the plaster better than lime, and the product was a pure white in color.

He used two methods. In the first he calcined the magnesites sufficiently to release the carbonic acid, and then reduced this caustic magnesite to an impalpable powder; then mixed it in the proportions of 15 to 30 per cent with the plaster, and tempered it with water; worked it up, and when the object thus made was dry, he poured over it a solution containing from 20 to 30 per cent of sulphate of zinc (if the objects are small, they are steeped about an hour in the solution); they are then dried and polished, and the product is found perfectly hard.

In the second method, when the solution fails to penetrate properly into the object, M. Mallion tempers his mixture of plaster and magnesia directly with the sulphate of zinc solution, a little less concentrated than before, and then at once uses it for the purpose intended. The resulting mass is homogeneous, handsome to the eye, has an astonishing resistance against crushing, and only an iron point will make an impression upon its surface.

The zinc solution is used on all objects that it is desirable to have remain white; in this manner are made fine statuary, mouldings of extraordinary beauty, blocks for statuary, fireplaces, columns, and ornaments of all kinds. By lining the interior of the moulds with plates of zinc, or better still with glass, the product will have the polish of marble. The richest marbles can be likewise imitated by simply tinting certain portions of the mixture of plaster and magnesia and disposing them with judgment and art. For floors, it is better to replace the sulphate of zinc by a solution of iron, which will give to the compound a very beautiful color, similar to pinewood, and this can be rendered still more pronounced by rubbing it with linseed oil.

To obtain the best results with this process two things are requisite: the magnesia must be free from silica, and it must be calcined very regularly. For the latter purpose a gas furnace, of the Siemens or Schwandorp type, is the best.

The best of the magnesites for this purpose are undoubtedly those from the Grecian Archipelago, at Afrati, Mandoudi, Lesbos, or Corinth; it is sold for 27 francs per ton on the ground. The average analysis is as follows:

	Afrati.	*Mandoudi.*
Carbonate of magnesia	94·50	97·53
Lime	4·15	0·75
Silica	0·75	0·15
Water	0·60	1·49
Alumina and oxide of iron	0	0·08

The magnesia of Germany is irregular in composition and too high in price. The Italian mineral is valueless on account of the great quantity of silica contained in it. The analyses from the principal sources of supply are as follows:

	Baldusiro.	*Casalette.*	*Island of Elbe.*
Carbonate of magnesia	80·75	86·30	84·49
Silica	18·50	13·25	12·85
Peroxide of iron, alumina, lime	0·75	0·45	2·80

These minerals are sold at from 20 to 30 francs per ton for the first two, and 33 francs per ton for the Elbe magnesia.

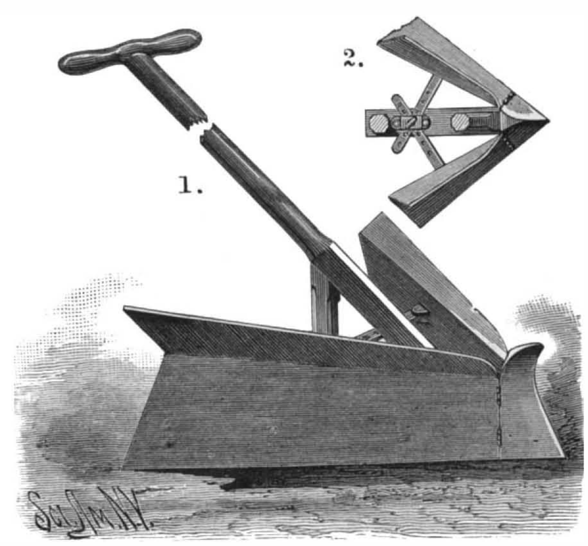
Galvanized Iron Water Pipes.

In the course of a paper on the above subject, by Dr. F. P. Venable, in the *Journal of the American Chemical Society*, he states that it has long been known that zinc dissolves in water, and that soft water, such as rain water, dissolves it more easily than hard water. Water containing carbonic acid is specially able to dissolve it. The use of galvanized iron for pipes and tanks being so much on the increase, the subject becomes more and more important, and it is desirable to ascertain, as far as possible, to what extent solution of the zinc coating takes place, and how far water contaminated by zinc is injurious to health. The author quotes several investigators as to the latter point; the evidence being to some extent conflicting, but giving a very decided balance on the side of the view that such water is considerably injurious.

Investigations made on behalf of the French Government resulted in the prohibition by the Ministry of Marine of the use of galvanized iron tanks on board men-of-war. Professor Heaton has given an analysis of a spring water, with a further analysis of the same water after it had traveled through half a mile of galvanized iron pipe. It had taken up 6·41 grains of zinc carbonate per gallon. Dr. Venable gives the results of an observation of his own, where spring water passed through 200 yards of galvanized iron pipes to a house, and took up 4·29 grains of zinc carbonate per gallon. It therefore seems pretty clear that drinking water should not be allowed to come in contact with zinc.

AN IMPROVED HAND SNOW PLOW.

The plow herewith shown is designed for ready adjustment for the making of paths of different widths. The share, secured to the front end of the bottom runner, is of wood, and is inclined to the sides and rear; a wing is hinged to each side of the share in such manner that it can swing to and from the frame, iron or steel runners being attached to the bottom edges of the wings, and their upper edges having flanges to prevent the snow from passing over into the inside, and to throw it back so far that it cannot slide again into the



FRANZ'S IMPROVED HAND SNOW PLOW.

furrow as the plow is pushed along. Fig. 2 shows in detail how braces attached to each wing cross each other on the central bottom piece or runner of the frame, where a pin may be placed to hold the wings adjusted at any desired width, or permanent braces may be used in place of the adjustable ones.

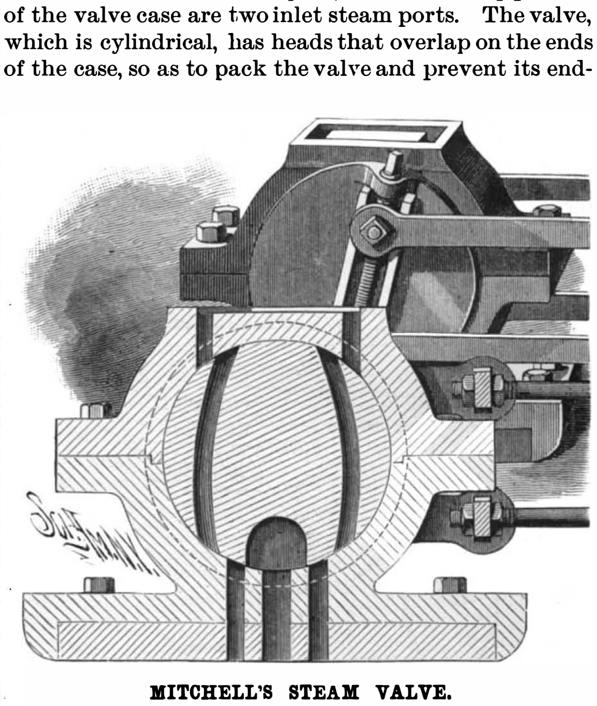
This invention has been patented by Rev. Julius Franz, of Warsaw, Ill.

Gas Engines of Large Power.

The company engaged in the manufacture of the Otto gas engines at Deutz, Germany, have recently erected a water works to the order of the authorities of the city of Duren. The pumps of the establishment are driven by two Otto gas engines, each of forty horse power. The same company have a similar contract which they are carrying out at Coblenz, where they will install two forty horse engines; and in addition to the above they will equip the city of Quedlinburg with a water supply plant, and operate the pumps thereof with gas engines.

A VIBRATING CYLINDER STEAM VALVE.

The illustration herewith shows transverse sectional and exterior views of a steam valve recently patented by Mr. William Mitchell, of Altoona, Pa. The case of the valve is formed of two half boxes, making part of or attached to a base plate, which may form part of an engine cylinder. In the base are two steam ports, and between them an exhaust port, while in the top portion of the valve case are two inlet steam ports. The valve, which is cylindrical, has heads that overlap on the ends of the case, so as to pack the valve and prevent its end-



MITCHELL'S STEAM VALVE.

wise movement. Transversely of the valve are two passages, placed to coincide with the top and bottom ports alternately when the valve is rocked or vibrated, the valve having an exhaust cavity corresponding with the exhaust port in the base plate. Two valves of this construction may also be linked together, so that both valves will be simultaneously rocked, each valve then having but one inlet passage, with the view of one valve supplying steam to one end of the cylinder and the other valve to supply the other end.

OPTICAL TELEGRAPHY.

(*Continued from first page*).

an apparatus which, like the one under consideration, is called upon to operate in the field. The lamp is furnished with a reflector, *r*, and a chimney, *m*, of sheet iron, provided opposite the flame with apertures in which glass is inserted. A groove in the bottom of the box allows of the passage of a screw, H, that serves to fix the lamp when, after experiment, the focus has been found. For this purpose the reflector is removed, and into the socket, T, there is introduced a tube, which is shown at I in Fig. 3. This carries at one extremity a system of lenses, and at the other a piece of ground glass. The end containing the lenses is turned toward the lamp, and the latter is moved until the flame is projected in the center of the ground glass.

This regulating being finished, the tube, I, is taken out, the reflector replaced, and the socket closed. When it is desired to use sunlight, which is much preferable, as the range is then greater, use is made of the tube, I I, which, likewise, is placed in the socket, T, after the lamp and its reflector have been removed. It will be seen that by means of a mirror, *b b'*, the solar rays are sent to a lens that concentrates them at a point, *s*, situated exactly at the focus, F, when the tube is in place. A heliostat moved by clockwork, and having a play of mirrors that are used as need be, permits of following the sun in all its positions (Fig. 1).

According to the place occupied by the receiving telescope, R, it will be seen that its axis is parallel with the axis of emission of the luminous rays. If, however, the box should get out of true and the parallelism be destroyed, the trouble may be remedied by slightly moving the telescope by means of the two regulating screws at V.

In order to obtain the necessary interruptions in the emission of the luminous fascicle to reproduce the Morse signals, there is arranged at about three inches from the focus, F, a screen, E E, which has in the center an aperture a little larger than the section of the cone which goes from the source to the objective.

In front of this aperture, and at the side of the source, there is a small screen, *a*, which completely masks it. This is movable, and, by means of a play of levers, may be maneuvered from the exterior by pressing upon a pedal, M. By giving the latter a quick blow we produce a short flash, while by allowing the hand to rest upon it for an instant we obtain a long flash. This maneuver is quickly learned, and we have recently found that any one who knows the Morse alphabet can, after a few hours' practice, send and receive an optical telegram.

The telescopic or mirror apparatus resemble those that precede, in many points. We find therein (Fig. 4) the box, A B C, the receiving telescope, L, the screen, *a*, maneuvered by the pedal, M, and the luminous source, consisting of a kerosene lamp or the rays of the sun. Instead of lenses for sending the light to the corresponding station, use is made of the properties of curved mirrors. These may be considered as being formed by the union of a large number of small plane mirrors. On applying to them the well known law that the angle of reflection is equal to the angle of incidence, and on examining Fig. 4, we shall easily understand the *modus operandi* of telescopic apparatus. A large concave mirror, R, is placed at A B at the bottom of the box, B C D, its focus being at F. Here might have been placed the luminous source; but, since the lamp would have then formed a screen, and intercepted a portion of the rays reflected, it has been preferred to place it externally in a second box, *a b c d*, which is affixed to the other. This has necessitated the use of some means of bringing back the luminous point to F. To effect this, an aperture, T, has been formed in the back of the mirror, into which has been introduced a tube provided with two lenses. The distance of these from the lamp is such that there forms at the point, F, a conjugate focus of S. The luminous rays that emanate therefrom are received upon a small convex mirror, R', at the extremity, D C, of the box, and are sent from thence to the entire surface of the large mirror at an angle that is so calculated that, after their reflection, they take a direction parallel with the axis of the apparatus. From the position of the screen, *a*, it will be seen that the conjugate focus cannot form and send rays to R' unless the manipulator has been acted upon and moved from its natural position.

The signals of the Morse alphabet, then, are reproduced with the same facility as in the lens apparatus. The kerosene lamp is here again generally employed, although the rays of the sun are also used along with the heliostat. The electric light has likewise been utilized, but without much success up to the present, for want of a sufficiently practical source of electricity, and because arc lamps are not steady enough, and their flickering renders the signals confused.

These apparatus are, as we have said, designed for permanent stations. They are usually established in forts—often under a casemate—and, once regulated in a definite position, are not thereafter to be moved.

It is not the same with the lens apparatus, as these are portable and designed for operations in the field. They are placed upon a tripod (Fig. 2), whose hinged table permits the instrument to be inclined in all directions. In fact, it will be seen that this is indispensable, since the position of the correspondent is known only approximately, and must be sought. For this purpose, after fixing the box upon the table by means of three screws, the eye is applied to the telescope, and the horizon explored in the direction in which the other station is supposed to be. By using a compass and a good map the station is generally found quite quickly, especially if, as we have supposed in the two engravings, it is a question of corresponding with a station established in a fort. When once the position is determined, the table is rendered immovable by means of a screw beneath it.

The operation is more difficult when it is a question of putting two movable stations in connection with each other. In this case it is preferable to await the

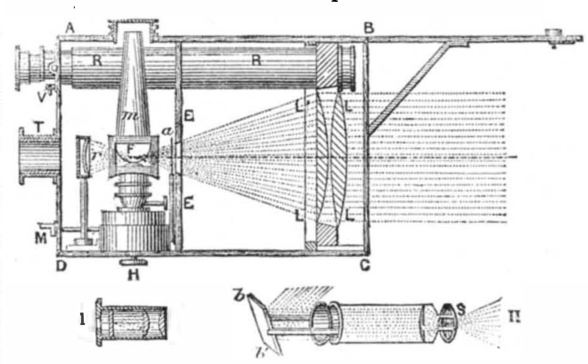


Fig. 3.—OPTICAL TELEGRAPHIC APPARATUS.

coming of night, since the light can then be better distinguished. It is necessary to have two operators for each apparatus. In fact, it would be impossible for one to remain long with his eye to the telescope, since in ten or fifteen minutes he would no longer distinguish anything. Moreover, in the receiving of dispatches the one who is observing, being entirely engrossed in catching the signals, cannot write them down, but must dictate them to his comrade in measure as he receives them. During the course of a transmission, too, the one who is doing the work must not lose sight of the other station, otherwise he may not notice that the latter is interrupting, in order to show by a special signal that the letter or signal just sent has not been understood, and that it needs to be repeated. During this time the other operator, while resting his eyes, is not idle, but is watching the flame of the lamp through a small glazed aperture in the side of the box, and keeping it in proper trim. In Figs. 1 and 2 may be seen the position of the operators for receiving and transmitting. In the first the apparatus is represented as provided with a heliostat. The tripod upon which it is fixed is of an old style, the table is not movable, and the boxes (one of them for holding the apparatus and the other for the accessories) are placed underneath.

As we have explained, it has been found more convenient to make the table very movable, and more practical to use the larger of the two boxes as a seat. As may be seen in Fig. 2, this box is provided with straps, and may be carried upon the back of a man. The smaller, which lies upon the ground, contains the kerosene can, some tools, some wicks, the regulating tools, the mirrors, and the heliostat.

Cases may occur in which one has not at his disposal so complete apparatus as the ones just described. In other cases the use of such may not appear to be necessary, on account of the slight distance between the two

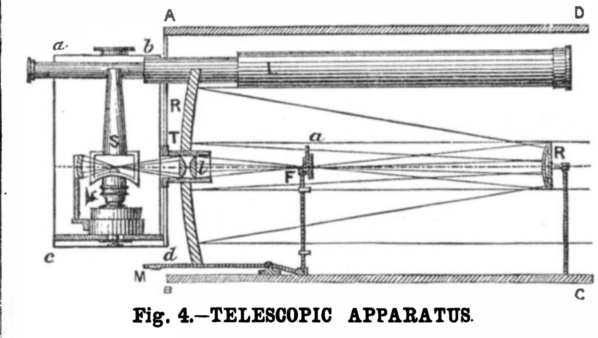


Fig. 4.—TELESCOPIC APPARATUS.

points that are to communicate, and yet it may be indispensable that the two stations, separated by some natural obstacle, like a river for example, shall be able to understand each other. Under such circumstances there may be used simple lanterns, like those belonging to a carriage. There is a small model made that may be fixed to the end of a stick or gun. In front of the glass there is a small Venetian blind, the slats of which are connected by a string that is held in the hand, and which permit, upon being opened and closed, of sending flashes of varying length. It has been found possible to communicate in this way to distances of 5 or 6 miles at night. For daytime squares of canvas fixed upon light frames have been used with success. A man holding one of these squares in each hand produces signals that have the same signification as the short or long flashes of the lantern. A single screen represents the dot, and two screens the dash. With a good field glass this kind of signals can be read from very far off.

As may be seen, optical telegraphy is based upon the use of the Morse alphabet; so the study of the latter cannot be too highly recommended. It ought to be known by everybody, for who can say whether he may not some day be called upon to make use of it for the safety of the country? In the last Tunisian campaign optical apparatus was used with success. More recently, at Tonkin, it permitted Lieut. Bailly to obtain succor, at an opportune moment, for protecting the retreat from Bac-le.

The army telegraph corps, although of quite recent organization, has already rendered great services, and will be called upon to render still more yet. The officers in command of it give the greatest attention and care to the instruction of their men, and are obtaining remarkable results. In the future, sure and quick communications will be secured for all the divisions of an army corps with each other or with strongholds, and that, too, despite the presence of the enemy above their lines, and without the enemy even knowing it; for in order to perceive the signals made by these lens or mirror apparatus, one must be in the axis of the luminous rays.—*La Nature.*

The Victims of Cholera.

The cholera has taken strong hold in Spain and on the southerly coast of France this year; every succeeding report from the infected regions indicates the gradual spreading of the disease, and the mortality is becoming frightfully great.

The season is so far advanced that the apprehension of the disease spreading to these shores this year has about subsided, but that it will cross the ocean and visit us next year is more than probable; therefore municipalities and individuals should not relax their efforts to put the streets in good order, and their houses and grounds in cleanly condition. This will do more than anything to keep the disease from our doors. Cholera seems to feed on filth and to abhor cleanliness. It seems also to like the glutton and the drunkard.

Frank H. Mason, United States Consul at Marseilles, France, has forwarded to the Department of State, Washington, some practical information concerning the prevention and treatment of cholera. His conclusions are derived from the studies of the epidemic of 1884 and preceding years in that city. He says that in its choice of victims cholera is most precise and definite. With rare exceptions the victims belong to one of the following classes: Those who live under bad hygienic conditions in respect to eating and drinking and exposure; those weakened and debilitated by alcoholic excess; and those who suffer from chronic digestive weakness or derangement. Among the imprudences which become dangerous in the presence of cholera are overeating to the extent of producing lethargy or indigestion, drinking any liquid so as to check the process of digestion, eating raw vegetables in the form of salads, and, in general, the use of raw fruits, unless perfectly fresh and ripe. Drinking cold water or beer after having eaten raw fruit is a direct challenge to cholera which no person, however strong and healthy, can afford to risk. The susceptibility of drunkards to choleraic influences is proved by abundant evidences, among which may be cited the sweeping fatality of the disease wherever it attacked inmates of inebriate asylums. Anything, in fact, whether of a temporary or chronic nature, which impairs the vigor of the digestive organs, exposes persons thus weakened to choleraic attacks.

Mr. Mason gives as the most effective destroyer of cholera germs in excretions the following solutions: Solution of sulphate of copper in the proportion of not less than 2 oz. to 1 quart of water; liquid chloride of zinc, 1½ oz. to a quart of water; bichloride of mercury, ¼ oz. to a quart of water; bichloride of copper, 2 oz. to a quart of water; sulphuric acid, 4 oz. to a quart of water. The same chemicals are used for disinfection of water closets, sinks, and all other seats of decay or infection. For washing streets and drains, sulphate of iron, 10 lb. in 220 gallons of water, or liquid chloride of zinc, 20 lb. in 220 gallons, has been found most effective and practicable. Phenic acid, in the proportion of 10 lb. to 220 gallons of water, was largely used at Marseilles last year, but the results were less satisfactory than expected, some experts even going so far as to affirm that the phenic principle preserved rather than destroyed the germs of the contagion. He says that in the face of a cholera epidemic diarrhœa is a serious illness, and should be treated accordingly. He also says that, as a popular remedy for immediate use, nothing has been found superior to chlorodyne, sold by most druggists.

Insoluble Cement from Glue.

In order to render glue insoluble in water, even hot water, it is only necessary, when dissolving glue for use, to add a little potassium bichromate to the water and expose the glued part to the light. The proportion of bichromate will vary with circumstances; but for most purposes, about one-fiftieth of the amount of glue will suffice.

The Volga River.

The number of vessels on the Volga is only a little less than 20,000. The chief products sent up the Volga are oil from Caspian Sea, fish from Astrakhan, salt from Tsaritsin, wheat, tallow, and hides from Samara and Saratov. The cargo of vessels that reach Nijni-Novgorod is estimated at 5,000,000 tons. From this point begins the distribution of these products in the middle Russia; 1,500,000 tons reach Ribinsk, and proceed to St. Petersburg by canal systems.

Down the Volga the cargo consists of 1,000,000 tons of miscellaneous goods and an unestimated amount of timber.

The Volga River is the largest in Europe. The thankful Russian people call it the Mother Volga. The Volga begins in a marshy locality, about 150 miles N. W. of Moscow, in the Tver Government as a small stream a few feet wide, which continually grows, receiving on both sides streams and rivers, some of which, like the Oka and the Kama, rank among the largest rivers of Europe.

The length of the Volga is about 2,500 miles, its width at the middle part about 1, and in lower part about 2½ miles. It enters the Caspian Sea; by means of three canal systems it is connected with Neva, St. Petersburg, and the Baltic Sea; by another canal system it is connected with North-Dvina, Archangel, and the White Sea, and now it is proposed to connect it with the Don River at Tsaritsin, and therefore with the Black Sea.

This immense water route, however, is not without defects. Every year it becomes shallower and shallower. Below Nijni-Novgorod the Volga is navigable for the large vessels, but above that place it is accessible only for smaller vessels, and during the dry summer of 1883 it was not navigable at all between Tver and Ribinsk. In May, when navigation begins, the Volga presents a magnificent sight, swelling at some places to 20 miles in width, but the water falls rapidly, and in the middle of June shallows or sand banks are formed which obstruct navigation. If a scow runs on such a bank, its cargo must be carried over with great expense. At the sand banks near the mouth of the Kama River, this overloading amounts to 500 to 1,500 tons every summer, and there is about a score more of such banks between that place and Ribinsk. Improvements obtained by the grated dams of Engineer Jankowsky and by dredging these banks are very inconsiderable, and it appears that the only radical measure is in enforcing the law which prohibits the wholesale destruction of forests.

Another great defect is the total absence of artificially improved harbors. Very often vessels caught by an early ice in October, and compelled to seek safety in the natural harbors, are moored to the ice through the winter, and in most instances are destroyed in the spring when the ice begins to move.

Above Ribinsk the Volga is not navigable at all, and vessels proceed further north by canal systems, of which the Marunskaia system admits vessels of larger size, and carries two-thirds of whole canal traffic. This system is a part of the great water route, and to give an idea of the system itself and the difficulties which await the vessels there, we tabulate below the different parts of which the Marunskaia system is composed:

a. 222 miles of open canals, on which scows towed by horses make about 20 miles per day at the cost of 24 cents per mile.

b. 170 miles down the rivers Sweer and Neva, on which scows make 33 miles per day, at the cost of 48 cents per mile.

c. 47 miles of canals with locks, the scows being towed by man-power at the rate of five miles per day and $1.20 per mile.

d. 249 miles up the river Sheksna, by horse and steam power, at the rate of 26½ miles per day and 90 cents per mile.

e. And finally, 14½ miles of rapids on the river Sheksna, taking at least seven days and costing $14 per mile.

The slowness of navigation is due in great part to obstructions and stoppages arising from the limited capacity of the system. Plans are under consideration now for a series of improvements to increase the capacity.

But in spite of all the difficulties, the navigation on the Volga grows every year, together with growth of commerce and production of that region. The latest and most powerful impulse in this growth has been given by the rapidly developing production of the Baku oil-region, which furnishes not only the cargo, but also cheap and excellent fuel for the Volga steamers.

REDUCED postage and other causes have increased the correspondence of the world. Less than fifty years ago the average of letters received by each person per annum was only 3 in the United Kingdom, and it is now 37 letters and 4 postal cards. The latest reliable ascertained comparison (for 1882, when the average was 35 in Great Britain) gives the average per head in the United States at 21; Germany, 17; France, 16; Italy, 7; and Spain, 5.

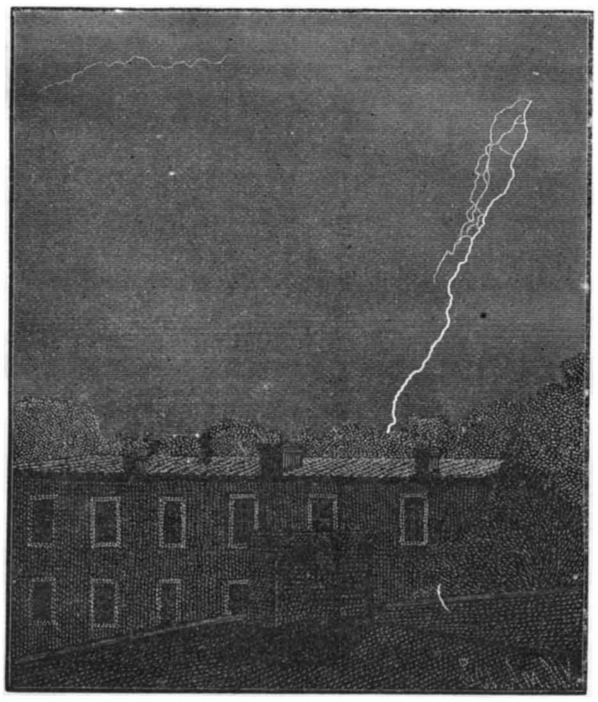
Correspondence.

LIGHTNING PHOTOGRAPHY.

To the Editor of the Scientific American:

I inclose a photograph of a streak of real "Jersey lightning," which I was fortunate to secure at 10:30 P.M., on Saturday, Aug. 1 last, after a great many "exposures."

The writer was led to try the experiment of photographing lightning, on account of a theory which he held, that lightning traveled in a wavy line, and not in a zigzag path, as drawn and painted by almost all our artists and painters. The result of these experiments would tend to show that the above theory was correct,



although the streak in this case certainly looked to the eye as if it was a thick zigzag streak tearing its way through the sky; but I think this zigzag effect was produced by the small streaks which branch out all the way down the main stem.

Additional interest is given to the photograph on account of a horizontal streak which occurred at the same time, which is shown, very faintly, near the top of the photograph.

W. N. JENNINGS, Photographer.

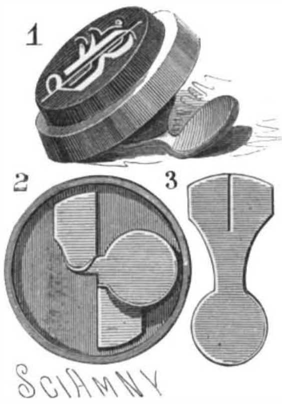
Philadelphia, August 10, 1885.

Torpedo Boats at Sea.

The records of the English torpedo boats at the recent function in Bantry is thus summarized by a London service journal: "The eight torpedo boats attached to the Hecla were terribly detached on the passage home. Only one remained near the parent ship, one made for Appledore, and has been sent for by the Seahorse, five put into Dartmouth, and one remained by the squadron. The misery suffered by the crews of these boats in a sea-way is great indeed, sleep being almost if not quite impossible; and we look forward with interest to the report upon the fitness of these little vessels for the work upon which they have been employed. Machinery repairs have been frequent, the strain upon the engines being very great, and no fewer than eight first-class and six second-class boats have been considerably damaged by their short cruise.

IMPROVED BUTTON OR STUD.

This button or stud has a twisted shank with attached plate, whereby the plate or bottom may be easily inserted into a button hole in a garment, and the button shank and plate together may be formed of a single piece of sheet metal bent into form, to be soldered or otherwise secured to the bottom of the button proper. Fig. 2 shows a bottom view of the button, and Fig. 3 the blank for forming the shank and plate in one piece. This invention has been patented by Messrs. Read Benedict and Harry M. Scott, who should be addressed for further particulars at No. 171 Broadway, New York city.



The Bryant Egg Beater.

Referring to the Bryant egg beater, engraving of which we published in SCIENTIFIC AMERICAN of August 22, we are requested to say that Messrs. Paine, Diehl & Co., 12 Bank Street, Philadelphia, Pa., are the manufacturers.

Flies and Their Relation to Disease.

It is a common belief that the absence of flies for a season is a percursor of an epidemic, and flies being this year less numerous than some other seasons, some of our contemporaries have reasoned that the cholera or some other dreadful epidemic is to inflict our land, or as one of contemporaries puts it, "without more flies, everybody is going to be sick, and a great many people are going to die." The process of reasoning on this subject is about as follows, given by a writer more rational than superstitious, which we find in the Midland *Industrial Gazette*: "The absence of flies does not exactly presage an epidemic—that is, the flies are not killed by the poison in the air, as many superstitious persons who have noticed the coincidence between disease and a small fly crop believe—but their absence is in itself a cause of sickness and epidemics. The scarcity of flies this year is attributed to the somewhat phenomenal weather prevailing in the North this spring. In February there was a remarkably warm spell, a mild temperature that hatched out most of the pupæ, and brought many of the little flies prematurely into the world. This was followed by a period of long continued and severe cold in March, which killed these young flies before they could get in their work upon the bald and sleepy. Hence a short fly crop. And now as to its relation with disease: The fly is a vulture, a buzzard on a small scale. It is the most important, because the most numerous, destroyer of pest-breeding material. It gets in on foul and decaying matter that can be reached by no other insect or animal, and it destroys it. The quantity of this pestilential matter thus removed cannot be estimated, because the fly is always getting away with it in summer, while in winter the cold prevents its evil influences being felt. When, therefore, there are too few flies to thoroughly consume all the forms of the dead and decaying substance that fills the earth, the surplus pollutes the air, the soil, and water, and creates and propagates disease. It is suggested, therefore, to New York, that, in view of its fly famine, that city stands in imminent dread of an invasion by that great enemy, the cholera, and the citizens are warned to be more than usually careful, and to supply the lack of fly by exercising extraordinary care in the removal of everything calculated to beget or nourish a pestilence."

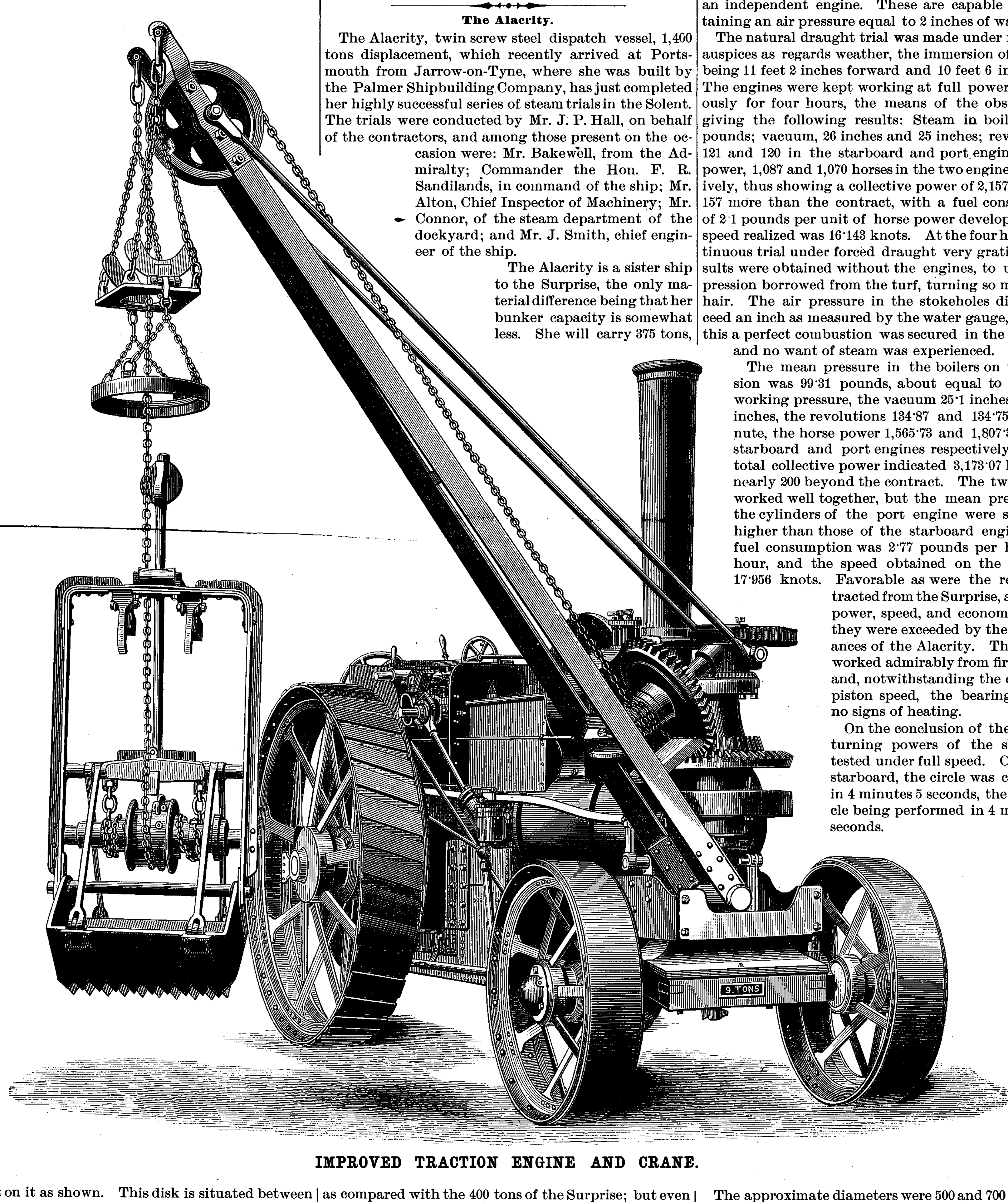
In contradistinction to the above, Doctor Grassi, in an article in the *British Medical Journal* in 1883, on danger from flies, claimed to have made an important and by no means pleasant discovery in regard to flies. It was always recognized, said the learned Doctor, that these insects might carry the germs of infection on their wings or feet, but it was not known that they are capable of taking in at the mouth such objects as the ova of various worms, and of discharging them again unchanged in their fæces. This point has now been established, and several striking experiments illustrate it. Dr. Grassi exposed in his laboratory a plate containing a great number of the eggs of a human parasite, the *Tricocephalus dispar*. Some sheets of white paper were placed in the kitchen, which stands about ten meters from the laboratory. After some hours, the usual little spots produced by the fæces of flies were found on the paper. These spots, when examined by the microscope, were found to contain some of the eggs of the tricocephalus. Some of the flies themselves were then caught, and their intestines presented large numbers of the ova. Similar experiments with the ova of the *Oxyuris vermicularis* and of the *Tænia solium* afforded corresponding results. Shortly after the flies had some mouldy cream, the *Oidium lactis* was found in their fæces. Dr. Grassi mentions an innocuous and yet conclusive experiment that every one can try. Sprinkle a little lycopodium on sweetened water, and afterward examine the fæces and intestines of the flies; numerous spores will be found. As flies are by no means particular in choosing either a place to feed or a place to defecate, often selecting meat or food for the purpose, a somewhat alarming vision of possible consequences is raised.

Purify the School Buildings.

The *Sanitary News* urges the sanitary examination of school buildings during vacation. To give force to its own opinion, it quotes the words of Mr. William Paul Gerhard, an eminent sanitary engineer. In a recent article on school and college sanitation, he says: "The annual vacation term would seem to be a particularly fit time to undertake a sanitary inspection of the school buildings, of their interior construction, sanitary arrangements, and of their immediate surroundings." He calls attention to the absolute necessity of such a periodical inspection, by qualified persons, and the correction of such structural and sanitary defects as may be discovered. While the water supply, drainage, and ventilation should be examined into, it is necessary to demonstrate the entire absence of dampness, and to examine the methods of lighting the class rooms, of heating the building, the means of egress in case of fire, the arrangement of seats and desks, and finally into the plumbing appliances.

IMPROVED TRACTION ENGINE AND CRANE.

At the recent Agricultural Show, Preston, England, Messrs. Aveling and Porter, of Rochester, had a large collection of engines, and among them an exceedingly handy crane engine, of which we give a perspective view, from *Engineering*. This engine, which is rated by the makers as a 6 horse, has done excellent work in getting exhibits into position, the crane with which it is fitted being capable of lifting loads of three tons, and both lifting and slewing by power. The arrangement of the gear is ingenious. The hoisting barrel is mounted on the crane jib, and is geared to a pinion running on the vertical shaft around which the jib slews, this pinion being fixed to a sleeve having a disk cast on it as shown. This disk is situated between two other disks, that above it being made solid with the bevel wheel to which the hoisting motion is communicated from the engine, while the lower disk is fixed on the central spindle forming the crane post, this spindle carrying at its upper end a quadrant geared into by a worm as shown, this worm giving the slewing motion. To the central disk first mentioned is fixed a bracket forming the fulcrum of a pair of levers actuating friction clutch gear as shown, these levers when depressed causing the central and upper disks to be frictionally connected, and thus making the hoisting motion available, while if raised the levers frictionally connect the central and lower disks, so forming a brake by which the load is upheld. The hoisting and slewing motions are both driven from a diagonal shaft which extends to the rear of the engine, and which is geared to the crankshaft so that it is always running while the engine is in motion. On this diagonal shaft are carried two bevel pinions, one giving the slewing motion to the right and the other to the left; by an arrangement of taper keys actuated by a clutch lever, either of these pinions can be driven as desired, and the load may be slewed in either direction, while the hoisting or lowering is going on. The whole arrangement is exceedingly neat and convenient, and the engine is capable of doing a vast amount of work. It is shown fitted with one of Priestman's diggers, which it is well adapted for working. With one of these diggers the engine has unloaded easily 70 tons of coal from a barge in a day of eight hours.



IMPROVED TRACTION ENGINE AND CRANE.

The Alacrity.

The Alacrity, twin screw steel dispatch vessel, 1,400 tons displacement, which recently arrived at Portsmouth from Jarrow-on-Tyne, where she was built by the Palmer Shipbuilding Company, has just completed her highly successful series of steam trials in the Solent. The trials were conducted by Mr. J. P. Hall, on behalf of the contractors, and among those present on the occasion were: Mr. Bakewell, from the Admiralty; Commander the Hon. F. R. Sandilands, in command of the ship; Mr. Alton, Chief Inspector of Machinery; Mr. Connor, of the steam department of the dockyard; and Mr. J. Smith, chief engineer of the ship.

The Alacrity is a sister ship to the Surprise, the only material difference being that her bunker capacity is somewhat less. She will carry 375 tons, as compared with the 400 tons of the Surprise; but even this reduced quantity will enable her, it is supposed, to steam 15 knots for about 14 days. The vessel is propelled by two sets of compound engines, each having a high-pressure cylinder, 26 inches in diameter, and one low-pressure cylinder, 50 inches in diameter, with a stroke of 34 inches. The main engines are horizontal, each pair being fitted with a horizontal air pump driven from the crank shafts. Her crank shafts are of Vickers steel, while the propeller shafting and the cylinder liners are made of Whitworth fluid compressed steel.

The propellers themselves are composed entirely of gun metal. There are two large horizontal condensers, formed also of gun metal, the water being circulated by two pairs of centrifugal pumps made by Allen. The fans and casings are likewise made wholly of gun metal. The pumps are fitted with large suctions from the bilges, and are thus capable of dealing with a considerable leak. Four special engines are provided for feeding the boilers, while two others of similar design pump out the bilges, and can also be employed as fire engines. The main engines are fitted with steam reversing gear of simple construction, and can be handled very easily. The piston and other glands are packed with the new patent asbestos cloth packing. Steam is provided by four steel boilers, two being 9 feet 6 inches in diameter, and two 10 feet 4 inches, the length of all being 17 feet 6 inches. The working pressure is 100 pounds to the square inch. The stokeholes are fitted with arrangements for forced draught, the air being supplied by four centrifugal fans, 4½ feet in diameter, driven by an independent engine. These are capable of maintaining an air pressure equal to 2 inches of water.

The natural draught trial was made under favorable auspices as regards weather, the immersion of the ship being 11 feet 2 inches forward and 10 feet 6 inches aft. The engines were kept working at full power continuously for four hours, the means of the observations giving the following results: Steam in boilers, 92·63 pounds; vacuum, 26 inches and 25 inches; revolutions, 121 and 120 in the starboard and port engines; horse power, 1,087 and 1,070 horses in the two engines respectively, thus showing a collective power of 2,157, equal to 157 more than the contract, with a fuel consumption of 2·1 pounds per unit of horse power developed. Her speed realized was 16·143 knots. At the four hours' continuous trial under forced draught very gratifying results were obtained without the engines, to use an expression borrowed from the turf, turning so much as a hair. The air pressure in the stokeholes did not exceed an inch as measured by the water gauge, but with this a perfect combustion was secured in the furnaces, and no want of steam was experienced.

The mean pressure in the boilers on this occasion was 99·31 pounds, about equal to their full working pressure, the vacuum 25·1 inches and 24·5 inches, the revolutions 134·87 and 134·75 per minute, the horse power 1,565·73 and 1,807·34 in the starboard and port engines respectively, and the total collective power indicated 3,173·07 horses, or nearly 200 beyond the contract. The two engines worked well together, but the mean pressures in the cylinders of the port engine were somewhat higher than those of the starboard engine. The fuel consumption was 2·77 pounds per horse per hour, and the speed obtained on the mile was 17·956 knots. Favorable as were the results extracted from the Surprise, as regards power, speed, and economy of coal, they were exceeded by the performances of the Alacrity. The engines worked admirably from first to last, and, notwithstanding the enormous piston speed, the bearing showed no signs of heating.

On the conclusion of the run, the turning powers of the ship were tested under full speed. Circling to starboard, the circle was completed in 4 minutes 5 seconds, the port circle being performed in 4 minutes 24 seconds. The approximate diameters were 500 and 700 yards, or about from six to seven lengths of the ship. At the end of the trial the Alacrity returned into harbor, when she will be completed to replace the Enchantress as Admiralty yacht. As it is proposed, however, to arm her and her sister ship, the Surprise, with six 5-inch breech-loading guns and four 3-pounder quick-firing guns, she will not be ready for the use of their lordships on their forthcoming visits of inspection to the dockyards.—*London Times.*

JUDGE FIELD, of the Supreme Court of the United States, relates in his memoirs, just published, that in 1862 there occurred a mysterious epidemic, the origin and nature of which have never been explained. A mere touch with the end of the finger was sufficient to convey the infection.

[SCIENCE.]

COMPOSITE PORTRAITS OF MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES.

Those of the members who were present at the Washington meeting of the Academy last spring will remember that, at the request of Professor Brewer and myself, they sat for their separate photographed portraits for the purpose of obtaining an experimental composite picture. Professor Baird kindly offered the facilities of the photographic department; and the pictures taken by Mr. Smilie, the photographer in charge, bear the same stamp of excellence that characterizes so generally the work of that department of the National Museum.

As only one or two previous attempts, I believe, have been made to produce composites in this country, I will state briefly what they are, and how they are made. The idea in its broadest sense was conceived and applied by Francis Galton, for the purpose of obtaining an average or type portrait, *i. e.*, a picture that should show the features that are common to a group of individuals, and exclude those that are purely individual. It is clear that in proportion as this result is attainable, the method will be of value in obtaining a clear conception of the external characteristics of any given type or class.

Galton reminds us that, during the first days of a traveler's meeting with a very different race, he finds it impossible to distinguish one from another, without making a special effort to do so; to him the whole race looks alike, excepting distinctions of age and sex. The reason of this is that, by short contacts with many individuals, he receives upon his retina, and has recorded upon his memory, a composite picture emphasizing only what is common to the race, and omitting the individualities. This also explains the common fact that resemblances among members of a family are more patent to strangers than to the relatives.

The individuals entering into these composites were all photographed in the same position. Two points were marked on the ground glass of the camera; and the instrument was moved at each sitting to make the eyes of the sitter exactly coincident with these points. The composites were made by my assistant, Mr. B. T. Putnam, who introduced the negatives successively into an apparatus carefully constructed by himself, and essentially like that designed by Mr. Galton, where they were photographed by transmitted light. The arrangements of the conditions of light, etc., were such that an aggregate exposure of sixty-two seconds would be sufficient to take a good picture.

What was wanted, however, was not an impression of one portrait on the plate, but of all the thirty-one; and to do this required that the aggregate exposure of all the thirty-one should be sixty-two seconds, or only two seconds for each. Now, an exposure of two seconds is, under the adopted conditions, too short to produce a perceptible effect. It results from this, that only those features or lines that are common to all are perfectly given, and that what is common to a small number is only faintly given, while individualities are imperceptible. The greater the physical resemblances among the individuals, the better will be the composites. A composite of a family or of near relatives, where there is an underlying sameness of features, gives a very sharp and individual-looking picture.

It would be difficult to find thirty-one intelligent men more diverse among themselves as regards facial likeness than the academicians entering into this composite. They are a group selected as a type of the higher American intelligence in the field of abstract science, all but one or two being of American birth, and nearly all being of American ancestry for several generations. The faces give to me an idea of perfect equilibrium, of marked intelligence, and, what must be inseparable from the latter in a scientific investigator, of imaginativeness. The expression of absolute repose is doubtless due to the complete neutrality of the portraits.

Fig. 3 contains eighteen naturalists and thirteen mathematicians, whose average age is about 52 years.

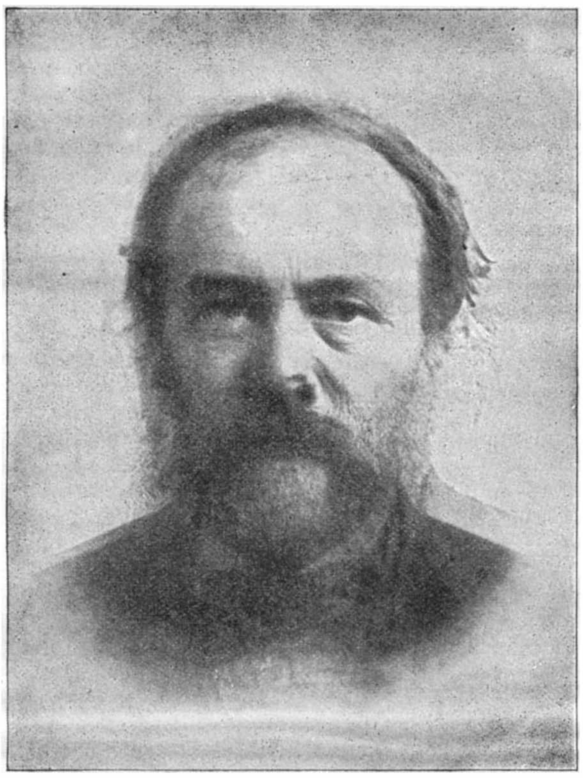


FIG. 1.—TWELVE MATHEMATICIANS.

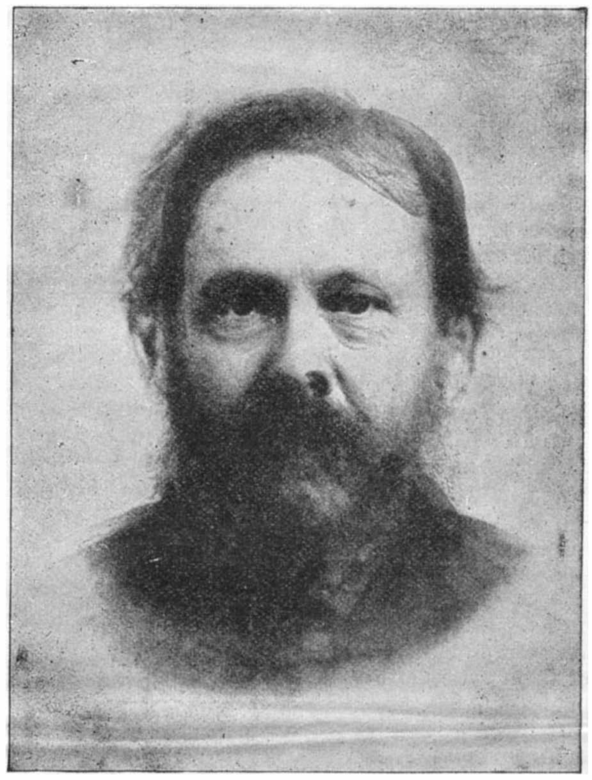


FIG. 2.—SIXTEEN NATURALISTS.

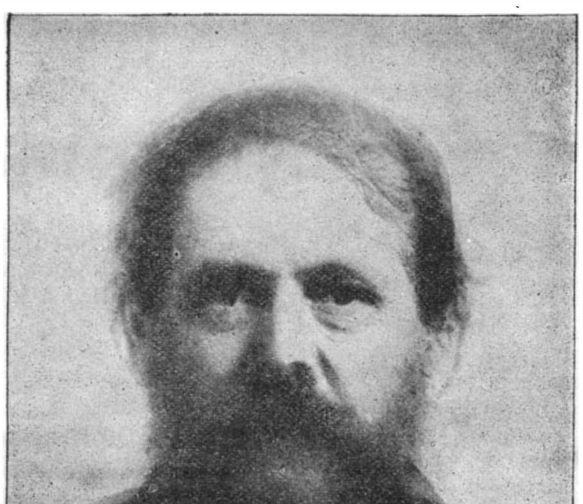


FIG. 3.—THIRTY-ONE ACADEMICIANS.

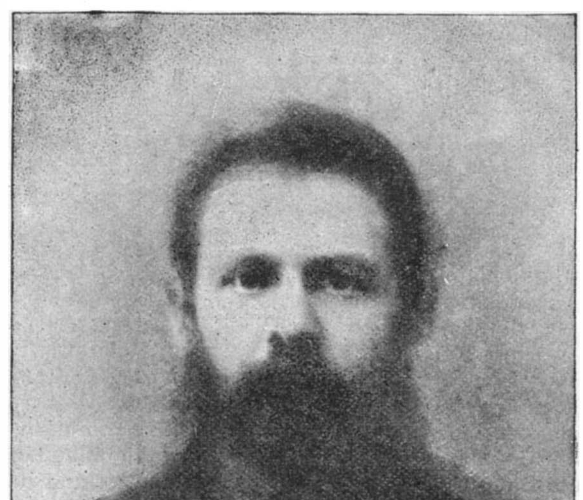


FIG. 4.—TWENTY-SIX FIELD-GEOLOGISTS, TOPOGRAPHERS, ETC.

COMPOSITE PORTRAITS OF AMERICAN SCIENTIFIC MEN.

Fig. 1 contains twelve mathematicians, including both astronomers and physicists, whose average age is about 51¾ years. Fig. 2 is a composite of sixteen naturalists, including seven biologists, three chemists, and six geologists, with an average age of about 52½ years.

I may mention, as perhaps only a remarkable coincidence, that the positives of the mathematicians, and also of the thirty-one academicians, suggested to me at once forcibly the face of a member of the Academy who belongs to a family of mathematicians, but who happened not to be among the sitters for the composite. In the prints this resemblance is less strong, but in these it was observed quite independently by many members of the Academy. So, also, in the positive of the naturalists, the face suggested, also quite independently to myself and many others, was that of a very eminent naturalist, deceased several years before the sitting for this composite.

There is given also a composite (Fig. 4) of a differently selected group. It is of twenty-six members of the corps of the northern transcontinental survey—an organization of which I had charge, and the object of which was an economic survey of the Northwestern Territories. It was a corps of men carefully selected as thoroughly trained in their respective departments of applied geology, topography, and chemistry, and having the physique and energy, as well as intelligence, needed to execute such a task in face of many obstacles. The average age of this group was 30 years.

RAPHAEL PUMPELLY.

Luminous Rays.

M. Charpentier has contributed to the *Comptes Rendus* some further observations relative to the distribution of luminous intensity and visual acuity in the olar spectrum. The author has studied the distribution of light in the spectrum, determining, by the aid of his photoptometer, the necessary and sufficient quantity of light which produces the sensation of light in different parts of the spectrum. It is accepted that luminous intensity, or brilliancy, is different from visual acuity; the former represents the exciting power of light upon the retina, the latter answers to the greater or ess facility with which this light permits an observer to distinguish the forms of small objects. These two manifestations of the power of light are not proportional to one another, but differ according to the refrangibility of the light. It is of interest therefore to study, by some rigorous method, the distribution of visual acuity belonging to the spectrum. The method adopted by M. Charpentier consists in ascertaining the amount of light necessary to enable an observer to distinguish a group of small points placed close together upon a black ground. The two curves which represent the distribution of brilliancy and visual intensity in the normal solar spectrum are notably different from one another.

The variations in brilliancy are less extensive than those of visual intensity. Both curves present a maximum; but the situation of this maximum is different in the two curves. The mean situation of the maximum of visual intensity is in the yellow, not very far from the D line. The maximum of brilliancy, on the contrary, is about the limit of the green and blue. This fact confirms the idea already expressed by the author, that the perception of light and of forms corresponds to two distinct physiological processes. It is remarkable that it is the latter—the perception of forms—which seems to be proportional to the absolute energy of luminous radiation. The other process—the crude perception of light—augments in intensity, not only with the absolute energy, but also with the refrangibility of the light. Luminous radiation seems therefore, according to all known facts, to act as a decomposing force, setting at liberty the potential energy accumulated in the photo-chemical substance of the retina during repose.

FIVE horses were lately killed by lightning in a singular manner at Camilla, N. Y. They stood with their necks over a wire fence, when suddenly the lightning struck the fence at a distance of 1,000 feet from the horses. The current traversed the wire, and went to ground through the horses.

Pygmies, Real and Fictitious.

In almost every country of the world, pygmies figure either in history or tradition; but tradition always has some foundation, man only weaves fiction from facts, and the best novelists are close observers of human nature. How many things long regarded as fables have been proved true? Herodotus, the father of history, who lived B.C. 484 years, was once called the father of lies, but we now know that he told only truth. Marco Polo, who in 1274 went with his father to Tartary, China, different parts of India, Persia, and Asia Minor, though an illustrious traveler and writer, was considered very untruthful, nevertheless the more we learn of those countries, the more truthful his accounts appear.

The stories of "little people," fairies, sprites, and elves, must have originated from the existence of an extremely diminutive race, a vague recollection of which has passed from generation to generation. Fables make the pygmies two feet high; the Greeks, having known of giants, as if to make a contrast pictured to themselves these pygmies, getting the idea from a certain people of Ethiopia, called Pechinies, who were very small. Swift made his Gulliver find men six inches high in the Isle of Lilliput; but Cyrano de Bergerac, in his imaginary voyage to the sun, found people not bigger than his thumb.

Among the many ludicrous stories told of pygmies, it is said that a certain King of Bavaria, at his wedding feast, was served with a pie from which a tiny dwarf, armed with lance and sword, jumped out on to the table, to the great astonishment of all the guests.

But apart from such extravagant tales, there are some proofs that very dwarfish people have lived in different places. Some years ago, on the banks of the river Merrimac, twenty miles from the Isle of St. Louis, a number of stone tombs were found arranged in symmetrical order; none of them were more than four feet long, and the human skeletons found in them only measured three feet, though the teeth showed that they were adults; the skulls were out of proportion with the rest of the body.

Aristotle, who was a great naturalist, said that trustworthy witnesses testified to the existence of minute men, and that they lived in caves washed by the waters of the Nile. Pliny even gives various details regarding their habits, and the geographical position of the places where they dwelt. On the banks of the upper Nile, where the Greeks placed the pygmies, modern travelers have found whole tribes of dwarfish men.

In Russia and Turkey, until quite lately, great sympathy was felt for dwarfs, they being generally considered keen witted and often talented. In Germany, in the eighteenth century, a dwarf was considered a necessary appendage to every noble family. In this present century there have been isolated cases of extremely small people, as, for instance, Richebourg, who died in Paris in 1858 at the age of ninety. He was twenty-three inches high, and during the revolutionary period he is said to have passed in and out of Paris, as an infant in the arms of a nurse, with dispatches very dangerous to carry wrapped in his baby clothes. In Mexico, especially in the State of Yucatan, and adjacent islands, there are many stories current about dwarfs; and if the natives are questioned concerning the builders of the old ruined edifices found in those parts, they invariably say, "The Puzob (pygmies) built them." In the islands of Cozumel and Mugeres there is a firmly rooted belief that "little people" wander around at night; many solemnly protest that they see them, and accuse them of disturbing their slumbers by hammering on benches and shaking their hammocks.

On the east coast of Yucatan there are various places, such as Nisuete and Meco, that any traveler may visit, though he must go armed, and keep a sharp lookout for Indians, who may fall upon him at any minute. There can be seen vestiges of small cities, all the houses made of stone, but not large enough for people more than two or three and a half feet high to occupy with any comfort.

In Cozumel Island we saw well constructed triumphal arches but nine feet high, and in the same place there are sanctuaries, temples of worship, built of carefully hewn stones; the doorway of the largest was three feet high, one foot six inches wide, the entire building measuring, outside, but nine feet in height, fourteen in length, and twelve in depth; we have in our possession plans of these buildings. The Indian who accompanied us to them affirmed that he always saw the "little people" at night, but they never spoke to him. He said: "They are very small, and wear big hats. Once, at the entrance of a cave in the forest, I found a clay figure, which was an enchanted dwarf, and it was reading a book; I picked it up to carry it home, but then I felt afraid and put it down again. Next day I returned to look for it, because I wanted to have the *puz* (dwarf), but I could not find the place."

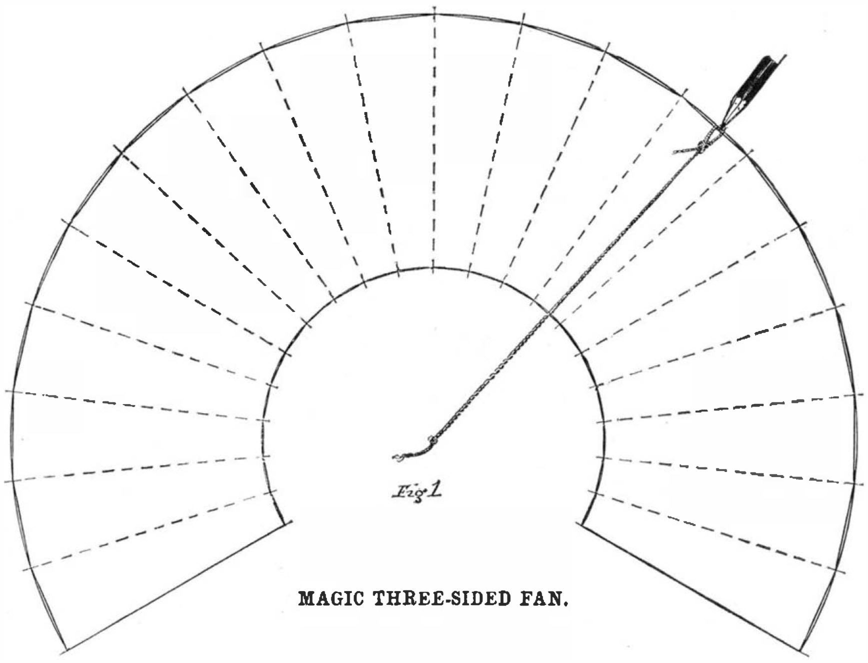
ALICE D. LE PLONGEON.

An Indian Cemetery.

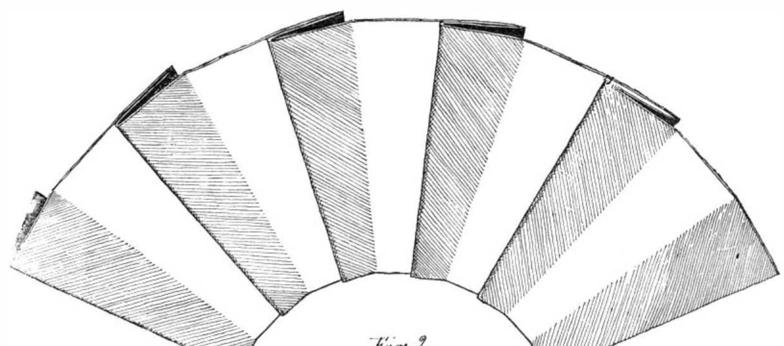
The small uninhabited island of Memaloose in the Columbia River, which is about 100 miles below Portland (Oregon), has from time immemorial been the burial place of the Indian tribes of the Wascos and Alickitats, among the famous Indian chiefs interred there being Malatowack and Powshensha. The customs observed after death among these two tribes are as follows: The bodies are swathed in fine linen bands, covered with a profusion of ornaments, and conveyed in a canoe to the island of Memaloose, where they are laid upon the ground until the rain, the wind, and the birds of prey have done their work. When nothing but the whitened bones remain, they are carefully gathered up and placed in a rough sarcophagus, where they are supposed to rest until the trumpet sounds on the last day. But the truth is that doctors, students, and collectors of fossils are continually going to this cemetery for skulls and skeletons.

A STATUE of Nicolas Leblanc is being erected in the Conservatoire des Arts et Metiers, at Paris—80 years after the great inventor perished of want. The stone given in place of bread is sometimes rather late.

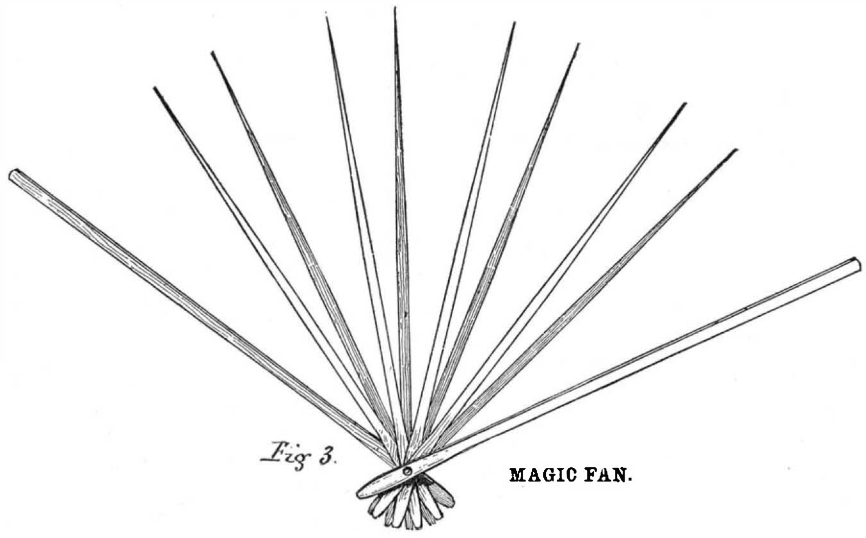
HOW TO MAKE A MAGIC THREE-SIDED FAN.



MAGIC THREE-SIDED FAN.



MAGIC FAN.



MAGIC FAN.

A fan that is equally applicable for winter or summer is a novelty. Such a fan any of the readers can make by following the directions given below, and they will be amply rewarded for their trouble by the looks of astonishment and wonder with which their work will be greeted, if introduced as part of some parlor entertainment during the winter, or casually opened and closed while fanning themselves on the piazza of their favorite hotel at the seashore. The third side of the fan is made by pasting eight of the folds together in four pairs. When the fan is open, one side of the pasted folds is concealed. The third side is shown by opening the fan the reverse way. The three sides are made apparent, without any explanation, by putting a different picture on each side. *Material Needed.*—All the material required is a sheet of stout paper twenty-five inches by nineteen; an old fan, or a piece of straight grained hickory about twelve inches long and quarter of an inch thick *How to Make the Fan.*—Lay the sheet of paper upon the table, and mark about three-fourths of two circles on it (see Fig. 1). The inner circle should have a radius of four and one-half inches; the outer circle, a radius of eleven and a quarter inches. Use the same center for each circle. If you have no dividers to make them with, a piece of string with a loop in one end, to place the pencil in, and a pin fastened in the other (and stuck in the table), will do equally as well (Fig. 1). Divide the outer circle into twenty equal parts, each part two and three-eighths inches wide. From each of these points rule a line to the center of the circle (see dotted lines in Fig. 1).

In cutting out the paper, cut straight from where the dotted lines cross the circles; do not follow the curve. The paper should be folded along the dotted lines. By running the thumb nail along each bent edge, the paper will be made to hold in place while the pasting is being done. The second diagram (Fig. 2) shows how the paper lies when ready for the sticks to be placed in.

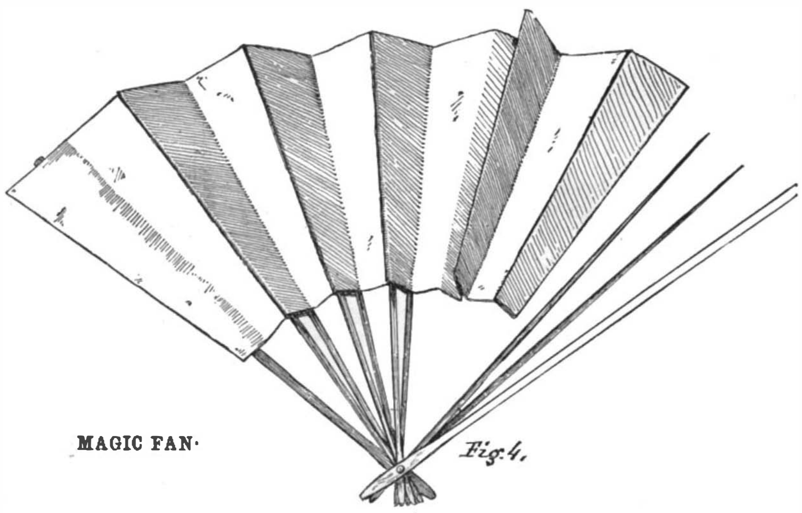
There are ten sticks in the fan; they may be got from an old fan by removing the covering, or whittled from a piece of hickory. The eight center sticks should be eleven inches long, quarter of an inch wide, and about the thirty-second of an inch thick. The two outside sticks are the same width, but twice as thick, as the center ones, and one inch longer. The eight center sticks should be tapered from about the middle until they come to a point at the top end. Three-quarters of an inch from the thick end of each stick, holes will have to be made to fasten them together; this can be done with a fine drill, or burned through by a wire heated over a gas flame (Fig. 3). To fasten the sticks together, bend one end of a piece of wire (about an inch long), in the form of a loop, small as possible, then push the straight end through the holes, and bend it in the same way. If the sticks of an old fan are used, and there are more than ten, remove the surplus ones, and fasten the proper number tightly together again.

To fasten the sticks to the paper, glue or mucilage will be the best thing. Begin by pasting the top stick to the center of the last fold to the right (as the paper lies in Fig. 2). When it has dried, turn the whole thing over, and after putting mucilage between the fourth and fifth folds, place the two undermost sticks between them, at the extreme edges of the folds; press between the palms of your hands and the table until they have had time to adhere. Then paste the two next sticks between the eighth and ninth folds; in the same manner. Now fasten the next two between the twelfth and thirteenth folds, and you will have progressed as far as shown in Fig. 4. The sixteenth and seventeenth folds will use up the two remaining center sticks. Now paste the last stick to the outside of the last fold, and close up the fan, allowing it to become thoroughly dry before putting on the pictures.

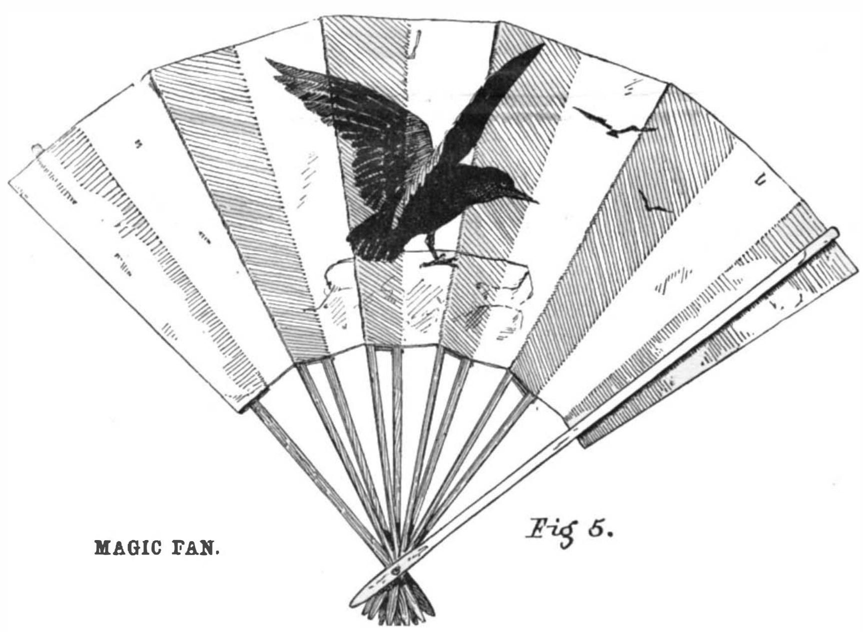
By putting only one picture on your fan, it can be made to appear and disappear at your wish, by opening and closing the fan in different directions. Be sure and get the picture on the flap side of the fan, or it will fail to make the magical change, because the other side does not alter, whichever way the fan is opened. If scrap pictures are used, they will have to be divided (with a sharp knife) along the edge of each fold that they cross, after being put on.

If you possess any artistic ability, it can be put to use by making some design, or taking some familiar story with three parts or incidents in it, and illustrating one on each side of the fan. For instance, the nursery rhyme, "The Three Crows," can be used by illustrating the first line on one side, the second on another, and the two remaining lines on the third side.

V. J. S.



MAGIC FAN. Fig. 4.



MAGIC FAN. Fig. 5.

Medicinal Plants in Brazil.

Consul Wright, of Santos, Brazil, incloses in his report to the State Department notes upon the medicinal plants of that country. The compilation is the work of S. S. Schindler, a native born citizen of the United States, who is now in Brazil. From Mr. Schindler's notes it appears that the country abounds in herbal remedies, and that alvelos, the new cancer cure, is but one of hundreds of plants or trees possessing properties of great value, as yet almost unknown to materia medica.

Alvelos is a shrub, Mr. Schindler writes, discovered by an eminent French physician of Pernambuco to be a specific for cancerous ulcers. The juice is a powerful caustic. Applied to cancer, it produces an irritating effect, which increases to a strong inflammation, and at length cicatrization takes place. The manner of application is this: A camel's hair brush is dipped in the juice, which is applied to the cancer and allowed to dry. Twenty-four hours afterward a little lint dipped in water is applied to the cancer, and in another twenty-four hours the juice of alvelos is tried again. Dr. Velioso advises for a speedy cure the application of the juice every day, using an infusion of tobacco instead of the arnica and water. This course of treatment is more rapid. The inflammation is much stronger, but can be regulated by the physician according to the nature of the cancer and its proximity to the vital organs. Mr. Schindler says that the alvelos treatment has proved successful in every case of cancer of the lips, tongue, nose, and breasts, where it has been tried.

Baycurn, Mr. Schindler says, is a curious plant of Brazil, which buries itself in the sand, a number of leaves rising above, seven inches long and two inches wide. The flowers resemble a saxifrage. The whole plant is sometimes for days together covered by the sea. The root is six to seven inches long, one inch thick, and tortuous shape. Externally it is chocolate brown; internally flesh colored. It is said to be an unfailing remedy in all kinds of enlargement and glandular swellings.

The juice of the fruit of the cajueiro tree is one of the most powerful blood purifiers known.

A decoction from the bark of the root of the calunga shrub is a remedy for dyspepsia and intermittent fevers.

The leaves of the camapa plant contain a narcotic principle, and the juice of the root and fruit is found excellent for rheumatism and liver diseases.

Boiled fruit of the avoredo pao tree makes a powerful poultice for ulcers. The fruit of the cabacinho has an admirable effect upon dropsy.

The most stubborn coughs yield to a tea made from leaves of the malavrisco shrubs.

Papaw has been found to possess the property of destroying the false membranes of croup and diphtheria.

Papaine is another diphtheria cure.

Poracary is said to be a sure antidote for bites of poisonous snakes.

Sapucareira bark makes a decoction which seems to be nature's remedy for kidney ailments.

There are no less than 312 plants or trees in Brazil which possess strong medicinal properties. Mr. Schindler's catalogue of them contains a remedy for every ill known to human flesh, and the wonder inspired in the reader is that people should ever die in that country.

How Milk is Spoiled.

Milk will absorb odors at one time when it would not at another. It readily takes in vapors and odors from the air when it is at the same temperature or colder than the air that surrounds it, but parts with its own odors when warmer than the air with which it is in contact. When cold air touches warm milk, the air expands and becomes lighter and rises. As it expands, its capacity for holding vapors, gases, or odors is so much increased that it is not only able to hold all the odors and moisture it contained before, but is enabled to take in more, and hence it is ready to take up, and does take up, any odor or vapor which is volatile enough to rise out of the milk. Thus, cold air, even if it is not quite as pure as one might desire it for breathing, does not contaminate warm milk, but, on the contrary, actually becomes an aid in purifying it. A pail of freshly drawn milk, so long as it remains much warmer than the air in a stable, may stand in the stable unharmed, provided nothing but the air, or what is in the air, touches it. If a vessel of cold milk is placed in warm air, the effect will be reversed. When warm air touches cold milk, the air becomes condensed, and its capacity for holding moisture and odors is so much diminished that it becomes unable to retain the load it was carrying, and is forced to deposit its burden on the surface of the milk, to be absorbed and held in the milk or its cream in the same way that the air on a hot day unburdens itself on the surface of a vessel of ice water, where the depositions become apparent in the form of dew. If a pail of warm milk and one of cold milk are placed side by side in the same stable, one may be growing purer and the other more foul at the same time, so much has the fact of temperature to do with the absorbing power of milk. Under the law of the diffusion of gases, aeriform bodies will, to some extent, force themselves into liquids like milk or water, when all are at the same temperature, but that law is largely controlled by relative temperatures. Does the reader ask how stable odors do get into milk, if not absorbed by the milk after it is drawn? The answer is, they get it through the breath of the cow. Standing in a stable filled with foul air, a cow cannot avoid taking in at every breath the odors with which it is loaded. Upon entering the lungs they are forced at once into the circulation. The blood becomes charged with them, and the milk, which always serves as a means of unloading the blood of its impurities as well as its nutriment, also becomes loaded with the odors intensified, greatly to the disgust of those who use the milk. It is surprising to those who have never carefully noted the facts, how soon and how effectually foreign odors, good or bad, are taken into milk in the air breathed by milk-giving cows.

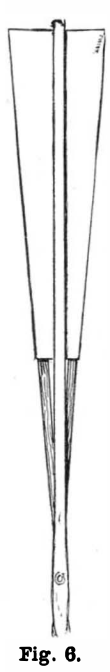


Fig. 6.

A few instances will illustrate. It is not long ago that an account appeared in the *Journal* of milk spoiled by being saturated with the odor of onions, from tethering a cow to the leeward of an onion patch. In the experience of the writer, twelve cows, in passing to and from their pasture, were subjected to the scent of a dead calf lying twenty rods from the lane through which they traveled. The exposure to the tainted air did not exceed one minute at each passage, and yet they inhaled infection enough to make their milk offensive, and to nearly spoil, for cheese making, the milk of eighty-five cows with which their milk was mixed. When the cause was discovered, the burial of the calf terminated the effect. In four different instances the writer has known of cheese being materially injured in cheese factories from the cows of one of the dairies inhaling air scented from dead calves lying round the barn in a state of decay. The annual reports of the dairy associations have often contained similar cases. Foul air is one of the readiest modes of contaminating milk. It will injure milk sooner than bad food. What is taken into the stomach may be, and often is, to a large extent neutralized by digestion, but infection taken into the lungs is at once, and without change, forced into circulation. There is no surer way of befouling milk than by forcing cows to breathe the confined air of their stables, saturated with the fumes of their perspiration and excrement. The consequence of breathing such odors is so plain and certain that it seems strange that it should be permitted to the extent it is. The assumption so commonly made, that the milk absorbs the scent after it is drawn, is doubtless one of the prominent causes. It is time that delusion was dispelled, and that dairymen should appreciate the fact that if they are to have pure-smelling and pure-flavored milk when their cows are in the barn, they must contrive to keep the odors of the stable from the nostrils of their cows, and give them pure air to breathe. Hurrying the milk out of the barn may be a good thing to do, but it will not remove the common cause and frequent occurrence of stable odors in milk.—*Live Stock Journal.*

Etched Printing Plates of Transferred Engravings.

The print may be cleaned by means of bread crumb; then, to soften the ink, the print is put to soak in a three per cent solution of strontic oxide, kept at a temperature of about 83° C.; the necessary time for soaking can be found by experimenting on a piece of margin or extraneous matter, cutting off a small piece, drying it, then dampening with nitric acid as hereafter described, and then observing whether it gives a set-off on being rubbed against another piece of paper with the thumb nail. The length of time may vary from ten minutes to an hour and a half. When the print is removed from the solution, it is thoroughly and carefully washed with hot water, superfluous moisture being absorbed by blotting paper; it is then laid face downward on a few layers of blotting paper, and the back well brushed with a 20 per cent solution of nitric acid, until the paper is thoroughly and evenly soaked; it is then dried between successive sheets of blotting paper. The zinc plate is prepared much the same way as for zincography, with the exception of graining; instead of this it is rubbed with water of Ayr stone, and finally polished with pumice powder.

In transferring, much stronger pressure is required than for zincography; indeed, theoretically, a copper-plate printing press should be used, but in practice a good litho press will be found to answer almost as well. After having adjusted the pressure, place the print face downward on the plate, and immediately pull it firmly and evenly through the press. An intervention of thirty seconds after the print is put on the plate would be fatal to success. After the print is peeled off, the plate is sponged over with unsoured gum water; water is then sprinkled on, and it is gently washed with a clean rag to remove any adherent particles of paper; the transfer on the plate is then rubbed over with a mixture of lithographic ink, thin varnish, and gum water, by means of a fine sponge, care being taken to have an excess of gum water to prevent "blacking up." When sufficient ink has adhered to the lines, the plate is flushed with water under the tap, and is then slightly etched with phosphoric acid and gum water solution, diluted with its bulk of water; the plate is next rolled up with printing ink, and re-etched with the normal solution. It is now ready for use, and can either be printed from in a litho press or it can be etched by acid, and then printed typographically. In preparing freshly printed matter the plate is at once saturated with the nitric acid solution, all further manipulation being the same, with the exception, perhaps, of rather less pressure in transferring.—*Printer and Stationer.*

Tide Mills.

A correspondent at Norwalk, Conn., writes that there are four tide mills within fifteen miles of there, and that in dry times this unfailing source of power is greatly appreciated by the farmers, long lines of wagons being seen, waiting to have the grist ground. Two of these mills are said to have single-acting turbine wheels, with a simple flap gate to admit water to the pond. Our correspondent suggests that there are probably many more tide mills in use in the country than is generally supposed.

ENGINEERING INVENTIONS.

A car brake has been patented by Mr. Edward Gardner, of Allegheny City, Pa. This invention covers a novel construction and combination of parts for operating the brakes of a car by hand levers connected with the brake bar in a simple way, so the brakes can be operated from either end of the car, and can be locked in place when set.

A switch stand has been patented by Mr. David Bowen, of Topeka, Kan. This invention provides a separable construction of parts in a railway switch stand, so that the operating spindle and its connections may be readily reached for repair and renewal, the shifting mechanism be protected in the base of the stand, and admit of direct parallel motion of the shifting bar.

A steam boiler has been patented by Mr. Joseph Ferrando, of Genoa, Italy. Combined with a boiler furnace are fire boxes upon which are the grates, a fire wall, and an air box, connected with the front ends of the fire boxes, the construction being such that pulverized or granulated fuel may be fully consumed, and not too rapidly drawn to the rear end of the furnace.

AGRICULTURAL INVENTIONS.

A self-cleaning plow has been patented by Mr. Allen Jones, of San Marcos, Texas. By this invention a blade is made to work on the plane face of the mould board by a wheel journaled in the plow between the mould board and the landside, so the wheel rolling upon the ground revolves the blade in the opposite direction, and intermittently cleans the mould board.

A combined band cutter and grain feeder for thrashers has been patented by Mr. Charles Grover, of Kansas City, Mo. This invention covers a novel construction and combination of parts to make a machine not liable to get out of order, for cutting the bands of bound grain, and for feeding the bound and headed grain to thrashers in uniform quantities with such rapidity as the thrashers may require.

MISCELLANEOUS INVENTIONS.

A self-binding harvester has been patented by Mr. George W. Blakeslee, of Perry, Iowa. This invention covers a novel construction and combination of parts intended to secure compactness and efficiency in self-binding harvesters, and promote simplicity and cheapness in their construction.

A sad iron has been patented by Mr. Horace S. Pease, of Portage, Wis. It is an improved smoothing iron which can be used for polishing, fluting, and pressing, and easily adjusted for either purpose, a curved fluter being secured to the handle, and the smoothing iron having a fluted surface.

A hair clipper has been patented by Mr. Walter H. Underwood, of Denver, Colo. The clipper device has an abrading wheel in contact with the cutter, whereby the cutter is automatically sharpened as it revolves, and the device has other novel features of design and construction.

A stock releasing device has been patented by Mr. Theophilus Arndt, of Florin, Pa. This invention covers novel features of construction of a device adapted for operating independently or collectively, so the animals secured thereby may be released separately or all at once, as may be desired.

A carpet stretcher has been patented by Mr. Charles Grover, of Kansas City, Mo. It is made with a main lever and a bar, with a head carrying points at both edges, so the user can both pull and push the carpet to stretch it, and the device can be folded in small compass when not in use.

A slate pencil sharpener has been patented by Mr. John Putnam, of Philadelphia, Pa. It is made of pressed glass, with its abrading surface formed by impression in the mould, making it virtually indestructible, while it does not absorb moisture or grease, and may be made of any desired shape or size.

A pick attachment for dredge buckets has been patented by Mr. John McSpirit, of Jersey City, N. J. Combined with the frame of a dredge bucket are picks pivoted thereto, and a hook to hold them out of the way when not required for use, so the bucket can be used to loosen hard ground when desired.

A quoin and side stick for printers has been patented by Mr. Marshall J. Hughes, of Jersey City, N. J. It is composed of an oblong metal band inclosing a wooden block, with projections from the top plane for use in driving, the different sections being adapted for use both as side sticks and quoins.

A bench clamp has been patented by Mr. Franklin P. Hish, of Shelbyville, Ill. This invention covers a novel construction and combination of parts to provide a simple, inexpensive, and easily handled bench clamp, for use in holding the work to the bench while being jointed or otherwise finished for use.

A safety gate for elevators has been patented by Mr. George T. Fallis, of St. Joseph, Mo. The construction is such that the gate may be automatically opened and closed, and locked when closed as the carriage passes the gate in either direction, and so the gate may at will be prevented from opening.

A barn door fastening has been patented by Messrs. William L. Bliss and George F. Kopp, of South Egremont, Mass. It consists of a vertical shaft placed in suitable bearings on the barn door, with latches and a spring lever, and triangular latch plates on the barn, to automatically lock the door at top and bottom when it is closed.

A saw gummer has been patented by Mr. James R. B. Hunt, of North Troy, Vt. By this invention the cutter head for cutting out the throat of the saw tooth may be operated against the side of the saw instead of against the edge, to the end that the operation of gumming may be done quickly and without danger of drawing the temper of the saw plate.

Saw mill set works form the subject of a patent issued to Mr. Charles W. Metcalfe, of Hopkinsville, Ky. This invention covers improvements in works in which the movement of the knees of the head blocks is automatically effected to set the log up to the saw for each slice sawed off, this automatic set being made by the progressive movement of the carriage.

A fastening for egg carriers has been patented by Mr. Thomas W. Wells, of Gunn City, Mo. It has a spring catch or lock, beveled cleats attached to the case and to the lid to prevent the ends of the egg case from being laterally strained, with other novel details of construction to make an improved fastening for cases for carrying eggs.

A blotter has been patented by Mr. Homer L. Williams, of Lind Grove, La. According to this invention, a forked roll carrier has two rolls properly journaled, and with suitable handle to hold the rolls above the writing desk when not in use, one roller taking the ink from the fresh writing, and the other taking the ink from the first roller.

A tin can has been patented by Mr. Thomas C. Adams, of Brooklyn, N. Y. With a can and cover formed with an angular hollow rib in its flange is an annular wire cutter beveled to form a cutting edge to engage the hollow rib at the apex of its angle, thus furnishing with the can a cutting device to sever the top of the cover from the can.

A cover for milk cans has been patented by Mr. Daniel F. Crippen, of Riverside, Cal. It has conical ventilating tubes extending upward from the outside, and a removable screen inside to exclude foreign matters, so the animal heat and impure air may escape from the milk, and a constant circulation of air be maintained within the can.

A pencil or crayon holder has been patented by Mr. Frederick Froescheis, of Nuremberg, Germany. Combined with a tube for holding the crayon is a sliding tube acting on spring jaws which hold the crayon, so that the crayon is released by pressing on the butt end of the holder, and is held as soon as the pressure is removed.

A fence has been patented by Messrs. Aaron Zimmerman and John Q. Shipley, of Disko, Ind. This invention covers a new form of metal post, in which the base consists of a blade or fin of cast iron with a socket in its upper edge in which the post is held, in order to make a durable fence, and one which can be easily erected or taken down.

A velocipede has been patented by Mr. John W. Burroughs, of Salt Lake City, Utah Ter. This invention relates to vehicles adapted to be propelled upon common roads by the power obtained from a coiled steel spring, which unwinds as the vehicle moves along, and provides a novel construction and combination of parts for such vehicles.

A thread cutter has been patented by Mr. Benjamin F. Walker, of Allentown, N. Y. It is an attachment for a thimble, and the invention consists in relative construction and arrangement of the cutter and guard, the thread being passed between the guard and the blade, and a sidewise or downward movement of the fingers cutting the thread.

A bee hive has been patented by Mr. Lorenzo S. Cook, of Borden, N. Y. This invention covers a novel construction and arrangement intended to facilitate the removal of the honey frames, so the bees can be controlled in relation to the part of the hive in which they are to deposit the honey, and so the hive can be easily ventilated.

A machine for treating ramie and sugar cane has been patented by Mr. Louis U. Fasnacht, of New Orleans, La. It consists of a decorticator with revolving and stationary knife blades, rollers for pressing out the water from the fiber, and a drier with a hollow steam chamber under its bottom, over which the fiber is passed, with various other novel features.

A harness attachment has been patented by Messrs. Thomas G. Hanbery and John D. Wall, of Newstead, Ky. This invention consists of an improved loop, intended especially for use on dray and heavy wagon harness, to take the place of the ring and leather cup now commonly used, providing therefor a more simple, economical, and durable device.

A removable egg tray for incubators has been patented by Mr. Frank Rosebrook, of Elmira, N. Y. It consists of a frame with wire netting bottom, beveled strips in the frame and dividing the tray into compartments, the strips being separated from each other a distance equal to the length of an egg, the arrangement being such that eggs can be reversed easily, and are fully exposed to the action of the heat.

Gold and other metallic amalgams form the subject of a patent issued to Mr. Solomon P. Buatt, of Bastrop, La. This discovery relates to amalgams suitable for dental fillings, whereby gold and silver may be reduced to a plastic mass with mercury, and a crystallized solid obtained free from excess of mercury, chemical impurities, or metallic oxides injurious to health.

A saw swage has been patented by Mr. William C. B. Hummel, of Winfield, West Va. It is for upsetting the points of saw teeth to broaden the points, and is intended to guide the swage relatively to the plane of the saw, so its action shall not tend to cant the teeth to either side, and so the swage may be quickly placed properly on the tooth without special care on the part of the operator.

A wagon jack has been patented by Mr. John F. Eastman, of Triumph, Ill. Combined with a hollow standard in which is a toothed bar, is a clutch plate through which the toothed bar passes, a lever pivoted on the standard having a curved cam part on its upper end adapted to act on the clutch plate, the device being easily adjustable for wagons of different heights.

An automatic oiler for lubricating wool has been patented by Mr. John C. Thickins, of Hinsdale, Mass. Combined with a tank for holding a lubricating agent is a sprinkler and measuring device for supplying only measured quantities, with other novel features, the whole apparatus being designed to be arranged in the upper part or immediately over an automatic feeder of the wool to the first breaker cards.

An adjustable reflector holder for stationary lamps and other lights has been patented by Mr. William J. Wilkinson, of Philadelphia, Pa. Its construction is such that by operating a hand screw the reflector can be raised or lowered to adjust it to the proper height, or by loosening another hand screw it can be tilted to allow the chimney to be inserted or removed, or to focus the light upon any desired spot.

A hog feeder has been patented by Mr. Ayland M. Carter, of Cincinnati, Neb. The reservoir will hold sufficient feed for two or three days' consumption, and the feed will be distributed to all the animals alike, and it may be so placed that the crank and valve handle may be reached from outside the pen or fence to stir the feed and deliver it to the trough without requiring the attendant to be near the animals.

A game apparatus for playing amusing and instructive games has been patented by Mr. Samuel L. Clemens, of Hartford, Conn. The invention consists in a player's chart with a series of rows or columns of numbers, with a hole for each number, which may represent the years of events of historical importance, in contesting the number and accuracy of which remembered by the players the game consists.

A safety brake for elevators has been patented by Mr. John W. Metz, of Manchester, Ohio. This invention covers a novel construction and arrangement of cam headed grip levers and operating levers, both pivoted to the elevator carriage, and connected by links and pull cords leading to the carriage within reach of its occupants, giving a simple means of stopping the carriage should the hoisting rope break or other accident occur.

An attachment for stop motions of knitting machines has been patented by Mr. Oliver H. Edwards, of New York city. Cutting blades are mounted on a support above the needle cylinder, the blades being held closed by a spring and open by a lever having a yarn guide in one end, so that when a knot in the yarn encounters the guide the blades will be released and the yard severed some distance from the needle cylinder.

An ironing machine has been patented by Mr. Frank Corbett, of New York city. With the end frames and hollow journals of the upper roller are connected half bearings attached to perforated plates, with loose plates between their upper ends, to which are swiveled crank screws, and between which and the half bearings are interposed springs, whereby the upper roller can be readily adjusted to give any desired pressure to the goods.

A valve oiler has been patented by Mr. Samuel D. Mershon, of Rahway, N. J. It is made with a jointed discharge rod connected with a crank pin attached to a screw wheel meshing into an endless screw, the shaft having a pulley to receive a driving band, so the oil will be made to discharge with certainty at regular intervals of time, the invention being an improvement on a former patented invention of the same inventor.

A dynamo electric machine has been patented by Messrs. Holbrook Cushman, of New York city, and Joseph P. Hall, of Oldham, Eng. This invention relates especially to the construction of the armature, which is so arranged that the conductor will be exposed to the inductive influence of the magnetic field under the most favorable conditions, as well as to promote simplicity and economy in the manufacture, and the easy renewal of parts.

An adjustable scraper for cracker machine feed rollers has been patented by Messrs. William H. Bromley and Philip J. Gately, of Brooklyn, N. Y. Combined with the feed rollers are arms having intermediate bars with grooves opening at their inner edges, plates fitting in said grooves and having eyes upon the lower rear edges, and screws working in the intermediate bars and swiveled in the eyes of the plates, to keep the feed rollers free from dough.

The manufacture of finger rings forms the subject of a patent issued to Mr. Edwin E. Hanf, of Wilmington, Del. The new method consists in upsetting the ends of the blanks, bending into circular form to bring the ends together, uniting them by fusion and rounding up the ring, condensing the metal by hammering, incidentally bringing it to size and turning off its surface, so the ring will not have distinguishable joints, and will appear as if stamped out from a plate.

A process for making sirup and beer from maize has been patented by Mr. Alfred E. Feroe, of Poughkeepsie, N. Y. Its object is to fully utilize the corn without the use of acids or chemicals, the starch of the meal being first liquefied and separated before conversion from the coarse insoluble portions and insoluble fatty acids in a specially contrived separator, the fine insoluble portions being removed after conversion by a further novel treatment avoiding filtration, it being claimed that such process improves the product and shortens and cheapens the whole work.

NEW BOOKS AND PUBLICATIONS.

PLUMBING PROBLEMS: or, Questions, Answers, and Descriptions relating to House Drainage and Plumbing, from the *Sanitary Engineer*. New York: The *Sanitary Engineer*, 1885.

For some time past, the discussion of problems relating to house drainage and plumbing, in answer to the queries of the correspondents, has been a special feature of the *Sanitary Engineer*, and the frequent repetition of these questions has induced the editors to reprint in the present volume a selection of those of more general interest. They have made a division of the subject under several heads, giving the first attention to a description of constructions which should *not* be imitated. And these, it may be remarked in passing, seem to be the sort usually found in modern houses, and quite justify their discussion at the outset. The chapters on house draining, miscellaneous problems, and the circulation and supply of hot water are of considerable interest, and furnish information in directions where experience seems to show that it is much needed. The form of the book, a collection of detached solutions, is naturally not so convenient as a well arranged treatise would be, but this is a penalty which one must pay for the latest information on almost any subject. The work is well illustrated with cuts.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) T. B. writes: I am building a canvas boat. Would you kindly let me know what the preparation is that is put on the canvas previous to painting? A. The canvas is painted with a coat of raw linseed oil on the inside before it is put on the boat, then when on the boat it is painted with two coats. A cement of pitch, gutta percha, linseed oil, and litharge is also used. See "The Construction of Canvas Canoes," SCIENTIFIC AMERICAN SUPPLEMENT, No. 216.

(2) D. J. C. writes: Do you know of any way by which I can reduce balsam fir to a liquid state, so as to put it in a "cough medicine" which I am trying to make? I do not wish to use alcohol, but expect to use glycerine instead. Would 1 ounce of glycerine be too much to put in a common sized bottle to preserve the medicine? I expect to use hoarhound, licorice, mullein, balsam fir, and other things in it. A. Balsam of fir is soluble in turpentine, but as the latter may be objectionable for your purpose, we would suggest that a simple mixture be made with your other ingredients. As to the quantity of glycerine, the amount mentioned seems sufficient for preservative purposes.

(3) A. D. L. & Co. ask (1) how to make a preparation for coating canvas to make tarpaulin. A. Softsoap is first dissolved in hot water, and a solution of copperas (ferrous sulphate) is added. The sulphuric acid combines with the potash of the soap, and the oxide of iron is precipitated with the fatty acids as an insoluble iron soap. This is washed and dried and mixed with linseed oil. The addition of dissolved India rubber greatly improves the paint. The foregoing preparation is then applied to the canvas. 2. The receipt for making eau sedative? A. Dorvault gives the following. Take of:

Ammonium hydroxide	60	parts.
Tincture of camphor	10	"
Sodium chloride	60	"
Water	1000	"

Mix.

(4) J. F. S. desires a receipt for oxidizing silver black economically, without the use of platinum, and yet be durable. A. Perhaps the following may be satisfactory: Dissolve copper sulphate 2 dwts., potassium nitrate 1 dwt., and ammonium chloride 2 dwts., in a little acetic acid. Apply with a camel's hair pencil, but warm the article first, and expose the article to the fumes of sulphur in a closed box. The parts not to be colored must be coated with wax.

(5) C. M. E. asks: 1. Is coal oil composed (chemically) of the raw petroleum from which it was obtained? A. Coal oil is petroleum. Kerosene and naphtha are distillates of petroleum coming over between certain temperatures, and having certain densities or specific gravities. Their composition cannot be expressed by a simple formula, for they are mixtures. 2. What union or unions of the oil, air, and water take place when the first and last of the three are brought by heat to the gaseous state and ignited? A. The products of a perfect combustion are water and carbon dioxide, that is, the carbon of the fuel and the hydrogen of the same take up oxygen from the air, giving rise to the substances just mentioned. 3. What residue after combustion? A. There is generally a residue of carbon, or soot.

(6) W. W. A.—The manufacture of water gas on a large scale for illumination is cheap, and for any purpose cheaper than coal gas at New York prices for gas coal. It would not be practicable for domestic purposes.—Water grates made of gas pipe have been in use for many years. They have not been a success except on locomotives.—Do not know of an electric type writer.

(7) H. A. Z.—Moss agates can be ground on an emery wheel, but should not be ground dry. The proper way is to grind them on a lap of lead or copper with emery and water. Polish with a lead lap and rottenstone, and finish with a leather buff and rouge.

(8) J. M. G. writes: I wish to build a reservoir in which to store water for irrigating, to be circular in form, thirty feet in diameter, and the wall six feet high. My plan is to level and tamp the surface of the ground for the foundation, then drive small piles to the level of the tamped earth, placing them about six inches apart, and on this lay the floor for the reservoir of concrete, and on the floor build a wall of the same material to form the reservoir. A. We cannot see any value in the small piles. They will only disturb the original compactness of the soil by driving. Smooth down the floor on the natural bed of sandy loam, and fill in for the walls with such material as you have, mixed with any coarse gravel or broken stone that may be available. Make the sustaining bank 8 feet high, 18 feet thick at bottom, sloping equally on both sides. Then thoroughly wet the sides and bottom, and proceed to cement the bottom and sides with Portland cement and sand, equal parts well rammed, 3 inches thick. If you have good clay, a floor and sides of clay 8 inches thick, well puddled with a little sand and covered with sand several inches deep, makes a very good reservoir.

(9) W. S. H. writes: The architects of this country (Utah) claim that roofs covered with tin sweat, thus causing the tin to rust, and to prevent this they advise a coat of paint to be put on the bottom of tin before laying. Now, I would like to know if the lumber does sweat, as it is a great hinderance to tinners to paint before laying. A. It is not the lumber that sweats, but the condensation of water from the moist air in the room upon the cold roof—exactly the same phenomenon as the sweating of an ice pitcher. Your remedy of painting may save the tin from rusting, but will not entirely stop the condensation and dropping of water. A ceiling is the best. Thick roofing felt tacked to the roof sheathing and fitted snugly between the rafters will make you comfortable.

(10) W. G. L. asks: 1. Is coal in any way benefited by the use of water? A friend says that it will last longer and give more heat when wet. Is this so? A. A furnace that has a poor draught will do more work with a small jet of steam from the exhaust carried under the grate. Steam in passing through red hot coal is partially decomposed and carbonic oxide gas formed, which becomes an element of combustion in the fire chamber. There is no saving of coal, as the carbon of the coal is consumed in forming the carbonic oxide gas, but the draught is thus increased. 2. I read the other day of an engine that was run by the explosion of kerosene. Where can I find a description of such a machine? A. Many experiments with petroleum in explosive engines have been made. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 58, for illustrated description of such an engine.

(11) F. G. T.—To deaden the noise of a skating floor, lay on the present floor a cover of roofing felt; on the felt a layer of sand 1 inch thick; on the sand 4 inches square studding, and nail the skating floor to the studding. Have no solid connection between the two floors.

(12) H. W. desires (1) information concerning soluble essence of lemon—how prepared, as used in the manufacture of aerated beverages. A. The essence of lemon may be prepared as follows: Fresh oil of lemons 1 fluid ounce, deodorized alcohol (strongest flavorless rectified) 8 fluid ounces, exterior yellow rind of lemons (fresh) ½ ounce; digest 48 hours and filter. The essence of lemon peel, which is often used, is readily made by taking of the yellow peel of fresh lemons ½ pound, spirit of wine 1 pint; digest for a week, press, and filter. Said to be very fragrant. You will find in SCIENTIFIC AMERICAN SUPPLEMENT, No. 196, numerous formulas for "Artificial Fruit Essences." 2. Bisulphite of lime, bisulphite of soda, bisulphite of magnesia, as used for the preservation of malt liquors—how made, and what plant is necessary? A. Sulphurous acid is generated by burning sulphur; the fumes thus evolved are passed into the solution of the sulphite through suitable air tight tubes. Ordinary slaked lime suspended in water treated with the gas forms the "bisulphite." The sodium salt is made by treating a solution of sodium carbonate with sulphurous acid gas to saturation. The magnesium salt is prepared in a similar manner. No plant is necessary, only a few pieces of chemical apparatus.

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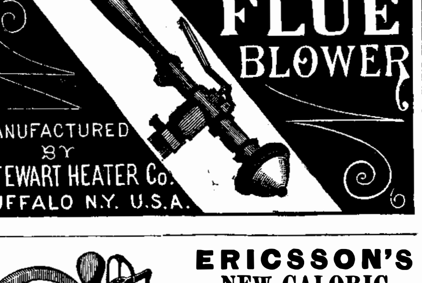

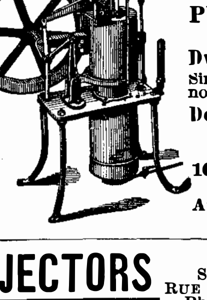

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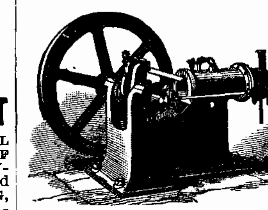

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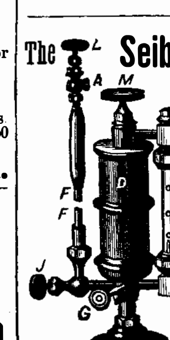

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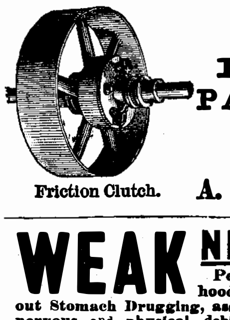

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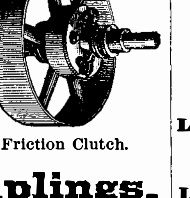

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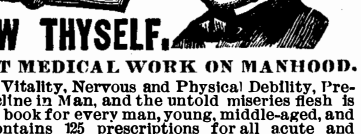

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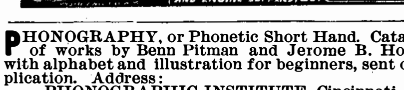

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