Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

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

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NEW YORK, SATURDAY, AUGUST 16, 1884.

REMOVAL.

The SCIENTIFIC AMERICAN Office is now located at 361 Broadway, cor. Franklin St.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 450,

For the Week ending August 16, 1884.

Price 10 cents. For sale by all newsdealers

THE GREELY EXPLORERS AT HOME.

It was on the 17th of July that the telegraph brought the news of the return of the Greely relief expedition to St. John, N. B., with Lieut. Greely and five of his companions who were rescued alive, and the bodies of twelve who had perished. Since then, with the more full details that have been furnished, the general sentiment of the country has strongly expressed itself in words of earnest commendation for both rescued and rescuers. The steamers composing the relief expedition, the Bear, Thetis, and Alert, were ordered to remain at St. John until metal caskets could be obtained for the bodies of the dead, and then to come homeward gradually to more southern latitudes, so that the yet feeble survivors might not be suddenly exposed to extreme warm summer weathe.

In accordance with this plan, the first official reception to the returning party on United States soil was given at Portsmouth, N. H., Aug. 4. There was a procession, in which Lieut. Greely was too weak to take a part, but which he reviewed from a balcony, and speeches were made by Secretary Chandler, Senator Hale, Representative S. J. Randall, Commander Schley, and others. The scene was an affecting one, and the exercises were marked by a simple dignity well according with all the circumstances of the occasion, Secretary Chandler concluding his address by saying: "To the rescuers and the rescued are these receptions most fitly given, and we are here assembled to do them honor; but our first duty is to pay our tribute of praise and of mourning to those devoted men who, after months of suffering and starvation, borne with heroic fortitude and patience, perished as truly on the field of duty as if they had met their fate at the cannon's mouth."

Lieut. Greely, in a letter which was read, bore strong testimony to the energy and skill of Commander Schley and the officers of the squadron, who so determinedly pushed their vessels through the ice packs to Cape Sabine earlier in the season than was ever before accomplished, adding: "Had they known our exact condition and locality, they could not have reached Camp Clary in time to have saved another life." In view of the blundering management of the former relief expeditions, however, the following portion of Lieut. Greely's letter must seem almost like grim sarcasm to the officers who had charge of them: "Never for a moment, in our darkest or gloomiest hour, did we doubt that the American people were planning for our rescue, and from day to day, as food failed and men died, that faith and that certainty gave strength to us who lived."

The business of the relief ships was formally ended on the 8th inst., when the remains of the dead were formally delivered by Commander Schley to General Hancock, at Governor's Island, New York. Each of the caskets was placed on an artillery caisson, and a column thus formed, the military with arms reversed, the band playing a dirge, and minute guns being fired, the procession moved to the hospital, where the bodies were left for final disposition according to the wishes of the friends or relatives of the dead heroes.

SCREW BOLT HEADS.

While machine screw heads are of the solid metal from which the shanks of the screws are turned, most of the screws and bolts used in woodwork have their heads struck up cold, as are those of rivets and of nails, or else hand forged or machine forged from the red hot bar. Rivet-made heads are necessarily made at one blow, the metal being cold, and to such an extent has this possibility of work been carried that bars of Norway iron, seven-eighths of an inch diameter, are worked cold into headed bolts, a single blow forming a head one inch and a quarter diameter. The amount of heat generated by the blow necessary to instantly change the direction of the fiber of the iron is such that the dropped bolt cannot be handled with bare hands for some time after its formation.

If the heat thus generated could all be utilized and concentrated on the head formation, the result might be something approaching a weld, and the head be a solid. But these rivet-headed bolts are not solid headed; the fibers of the straight bar are "broomed out," like the rays of a mushroom, without solid connections. This is caused partially by the suddenness of the change from perpendicular to transverse, and partially by the dissipation of the heat engendered by the blow, which is conducted from the rivet itself to the die and its surroundings.

When these heads are formed by successive blows while the iron is hot the result is somewhat different, as the fibers are gradually bent to the new direction, and near the shank they are partially welded. The heads of boiler rivets are generally welded, being brought to form under a white heat. But in the attempts to form heads by upsetting, it may be questioned if the violent redirection of the fibers of the iron in the cold rivet heading, or the slower bending of the fibers in the repeated percussion of the hammer while the iron is hot, retains the original tensile strength of the iron. It is certain that with the increasing diameter of the formed head from that of the original shank, the fibers of the iron must be forced apart, and consequently they must become less coherent as farther apart they go.

Machine screws generally are made on an entirely different principle. Instead of the shank being the original of the diameter of the screw, the head is taken as the measurement, and the difference between head and shank is turned off into chips. At first sight it would seem that there is a very great waste of material to produce the required result; but as an offset to this is the fact that the rapidity of manufacture compensates for much of this loss, and the uniformity of the product is particularly desirable. Beyond this is a claim made by thoughtful mechanics that the undisturbed relation of the fibers of the iron in head and shank is a source of strength.

However this may be, it is certain that the Spencer system of producing machine screws excels in rapidity, in exactness, and in uniformity of the product. The waste brings back more than half of the first cost of material, and at least seventy-five per cent of the oil used is saved by means of the centrifugal machine.

STRAIGHTENING SHAFTS.

Managers of machine shops and foremen of men sometimes allow shop practices that are ruinous to tools and injurious to the mechanics themselves. One of the most frequent abuses of this sort is the methods of straightening shafts for turning in the lathe. A common practice is to suspend the shaft on the lathe centers, and then, with a bar, using the tool carriage or the vee-ways of the lathe for a fulcrum, spring the shaft with a powerful leverage. Of course, the centers and the two spindles of the lathe have to bear the brunt of this trying ordeal, as may be supposed to their detriment as accurate portions of an accurate machine. Perhaps a worse practice is that of striking the shaft with a hammer while thus suspended on the lathe centers. Hardly less injurious to the shaft itself is the straightening on the anvil by sledge blows, the projecting ends of the shaft being left unsupported; it has been demonstrated by tests that the vibrations caused by this treatment diminish the torsional resistance of the bar. If a bar or shaft is to be straightened cold on the anvil, the ends of the bar should be supported on wooden horses. For short crooks in the shaft the hammer straightening should be preceded by heating to a "black" heat.

The proper way to straighten a shaft is the obvious one, by pressure—screw, or cam, or lever pressure. A frame with ways like those of a lathe can be made, either of iron or wood, to receive two head stocks with centers, one of the centers or both of them to be projected and retracted by a screw and hand wheel, as is the center and spindle of the ordinary lathe foot stock. If the frame is long enough, a supplementary double head can also be used between these two, having a center at each end, so that the process of straightening two short shafts may go on at the same time.

There should be a sliding carriage to traverse the ways between the heads, carrying a horse-neck screw press, and two vee-scored blocks, which can be moved nearer together or farther apart as the crook in the shaft makes necessary. The operation is simple. The shaft, having been centered by its ends, is suspended, and its "outs" ascertained and marked by rotating by hand and marking with chalk. Then, released from the centers, it rests on the carriage, which has been moved to one of the chalked points. A turn of the screw, the lower end of which is provided with a shallow vee-scored block that swivels on the screw, gives a pressure between the sliding vee-scored blocks on the carriage, when the carriage is moved to another chalked spot, repeating the same performance. The carriage is held to the ways of the frame by hooked clips that are attached to it, or it may be held in place by a bolt, bar, and cam, or wedge lever, as is the foot stock of some lathes.

With this contrivance two men can do a large amount of accurate work very rapidly. The rapidity of the work may be increased by substituting a cam lever for the screw, on the same principle as the lever used in bending and straightening railroad rails.

STEEL TESTS.

So many are the varieties of so-called steel nowadays that it is difficult to have a test that shall apply equally to all. But for tool steel its quality can be readily assured by a common smith's test. It should be understood that steel for tool purposes—for the cutting of the metals particularly—should be a composition capable of being hardened and drawn to temper. To be sure, it is claimed that there is suitable tool steel for certain cutting purposes that leaves the smith's hammer in good condition for use. It may be so, but it is evident enough that the proper condition of this steel depends upon its manipulation, and as that is less or more, the steel varies in resisting and durable qualities in use. Chrome steel and Mushet's steel are both valuable for certain purposes, but it is not always known when the proper quality or condition for these certain purposes is reached. Mechanics generally will prefer to guide the coming to condition by their own judgment, rather than to trust to the exactness of the manufacturer in proportioning the components, properly mixing them in a melted state, and afterward working the resultant.

The old-fashioned method of testing tool steel is as good a practical method as that of a careful chemical analysis. It is simply the heating and drawing under the hammer to a slender point, plunging while red hot in cold water, and when chilled striking it with a hammer across the edge of the anvil. If the steel will harden it will break, under these conditions, without bending back and forth. Steel that will not harden under these conditions is not fit to temper and will not retain a cutting edge. Steel that is so "high" that it cannot be heated red hot and chilled in water without flying may do for some purposes, and retain a sufficiently rigid edge by air hardening. If a piece of steel can be forged into a cold chisel, be hardened, tempered, and used, such steel is good steel, and may be relied upon for all ordinary shop purposes.

Experiment Stations.

The time has come when the profit of farming in the older States is so much a matter of shrewd management and careful attention to every point that the farmer who neglects these things is pretty sure to fail in his vocation. You cannot now simply "tickle the earth and make her laugh with a harvest;" you have got to do far more. Farmers have now begun to realize this as they never did before; and, among the many instrumentalities which they have called in to their aid, one of the newest and most important is the Agricultural Experiment Station.

The Experiment Station is not an American invention. It grew from a necessity which only the older countries vividly feel; and so it was imported here, if we are not at fault, from Germany. There is no subject on which the Germans do not spend thought; and even in their universities, where the subtleties of Fichte and Hegel employ the human mind at one end of the scale, the practical work of the house doctor suggests thought at the other. It must seem well that this is so and that all the agricultural interests are made a public concern. For farming is the occupation that feeds the world. If it is prosperous, the Wall Streets of the world are prosperous too; and this means universal comfort and success.

But the reader asks, perhaps, what it is that the Experiment Station does. The *Hour*, published in this city, gives the following brief account of its object: The Experiment Station is a farm, fully equipped and officered by the State, and set apart for the purpose of making experiments with fertilizers and original manures, soils, waters, milk, cattle food, etc. It examines seeds that are suspected of adulteration, or that are imperfect in any way; it classifies and reports upon all the various weeds, and makes studies of the different insect pests, while not forgetting to name the insects which are beneficial to the farmer. It is evident that in this way, through scientific investigators, a body of information can be procured which soon becomes of the utmost value to every farmer, and which he could not possibly afford to attain, if he could by any means attain it, for himself.

In the single matter of fertilizers—which are described as "commercial," because they are manufactured for sale—the benefit which the Connecticut Experiment Station has done alone has been incalculable. Hundreds and thousands of tons of worthless stuff had been sold to farmers before careful experiments proved their worthlessness, under names of attractive sound, that can no longer be sold to farmers who keep abreast of the times, and which are, therefore, virtually driven from the market. Even the relative value of fertilizers that are good is a point desirable to know; and the Experiment Station gives it, crediting the exact proportions and kind of matter that enter into each, so that all who will may know about them and make no mistake.

New York, Connecticut, and Ohio are among the few States that have established the Experiment Station; and the second annual report of the latter has just been issued. Its experiments the past year have been especially thorough with reference to wheat and corn culture, and are extremely useful to farmers everywhere. Those relating to wheat were published in September last, in a separate bulletin, and were widely circulated before the present harvested crop was put in. The experiments were not simply confined "to comparative tests of varieties, or yields of definite areas under the influence of different methods of culture and different manures." They include, as well, a careful study of the quality and vigor of the seed: the growth of the root; "the result of checking growth in one direction in order to stimulate at another; the effects of self and cross fertilization;" the best time and condition for performing the various processes of planting, manuring, cultivating, harvesting, and marketing; the treatment of insect enemies and diseases; a study of climatic conditions, etc. All these matters, so far as they can be, are well tabulated, and accompanied by literal text in explanation thereof.

The station takes into consideration also potatoes and garden vegetables, grasses and forage plants, and fruits and flowers. Its work upon the dairy and upon forestry is also given, so that nothing which concerns the farmer has been left undone. Fifty analyses of different kinds have been made, and over four hundred kinds of seeds have been tested during the past year. A great variety of grasses, weeds, grain, fruit, and vegetables have been received from farmers to be named and identified, and answers have been given in every case. In fact, the station is a natural bureau for inquiry, and wherever it exists it expects to be serviceable through private correspondence to the great constituency which it represents. Its monthly bulletins and yearly reports are accessible to all, and agricultural papers, and the press generally, circulate its conclusions on all the subjects to which it is devoted.

Other things which it does are to investigate and suggest remedies for rust, smut, mildew; to show the effect of different rations used to fatten stock, and the effect of the same upon the various dairy products; and the susceptibility of different breeds to different influences. All the processes of setting milk, separating cream, making butter, and the diseases of horses and cows, come within its province. Nor is drying and preserving fruit forgotten. The farmer is also told a very necessary thing in this age of rapid and reckless forest destruction—how the best trees can be easily and cheaply grown from the seed. The best time to cut timber, and the way to preserve it, is likewise shown. This service alone will be, in time, of untold benefit, not only to one State but to the whole country.

No State has ever devoted the public funds—small in amount though they are for this service—to better account than they render through the Experiment Station. The services such an institution renders in a single field in one year vastly overpays the whole expense of the Station for a long term of years. It is lamentable that the great body of farmers, as yet, themselves know so little about it; but they will come to know, in time, when its means of doing good will be immensely increased.

The Economics of Lead.

At the works of Messrs. Locke, Blackett & Co., London, may be seen the manufacture of sheet lead, lead tubing, red lead, and white lead. The sheet lead is prepared by pouring melted lead on a flat iron plate, and afterward rolling it between iron rollors. In the production of lead tube the lead is contained in a cylindrical vessel heated to a degree sufficient to soften but not to melt it. A piston propelled by hydraulic power forces the softened lead through an orifice the size of the pipe desired, in which is fitted concentrically a mandrel, or cylindrical core, the size of the interior of the pipe. The pipe, as formed, is passed over a pulley, and a coil of the desired weight is wound off on a windlass. "Compo" gas tubing is made in a similar manner.

To make red lead, the metal is melted in a shallow layer in a reverberatory furnace, by the products of combustion from a coal furnace passing over its surface; being thus gradually oxidized and converted into litharge. It is then extracted, and well ground and lixiviated with water. After this it is again exposed in a furnace similar to the first, when the litharge takes up more oxygen, and is converted into red lead. After another grinding and lixiviation, and drying by exposure to heat, it is ready for use.

The manufacture of white lead is rather more complicated. Litharge is ground and well washed in water until it is converted into an impalpable paste. A certain proportion of common salt is then mixed with it, which has the effect of precipitating an insoluble chloride of lead. This is allowed to settle, and is then treated with carbonic acid gas, which is supplied by means of a lime kiln. This secures the formation of white lead, which consists of a mixture of oxide and carbonate of lead. It is well washed, in order to remove all traces of soda, chlorine, etc.; and the white lead is then dried for use. The process for extracting silver from lead was also to be seen. For this purpose zinc is added to the lead when in a melted state, and it forms an alloy with the silver, which is less fusible than the lead, and at the same time lighter in specific gravity. Taking advantage of this principle, by means of a progressive process, passing the less fusible portions forward from one pan to another, an alloy of zinc and silver, containing but a small proportion of lead, is ultimately obtained. This is cast into hollow cylinders, and submitted to a blowpipe heat in peculiarly constructed furnaces, which has the effect of volatilizing the principal proportion of the zinc and lead, leaving the silver in a comparatively pure state.

Another process of manufacturing litharge was also in operation, consisting of blowing steam into contact with melted lead. The litharge yielded by this process is in a peculiar crystalline condition, well suited for the manufacture of white lead as above described.

Nutritive Value of Branny Foods.

At a recent meeting of the College of Physicians of Philadelphia a valuable paper on this subject was presented by Drs. N. A. Randolph and A. E. Rousel. The following are their conclusions:

The experiments of Rubner leave no doubt that a white bread contains more assimilable nutriment than one made from the whole wheat does, but this does not render it a desirable foodstuff for exclusive use. On the contrary, a weaned but still quite young omnivorous mammal thrives better upon an exclusive diet of bran bread than on white, and, presumably, because the earthy and alkaline salts are present in greater abundance in the former, and also because the indigestible constituents tend to give to the intestinal contents that bulk and consistence which are essential to the hygiene of the digestive tract. But, as has been shown by Edward Smith and others, the branny scales are needlessly irritating, and unduly hasten the passage of food* but partially digested. The end which popular hygiene attempts to effect by the retention of bran in breadstuffs can be better attained by other means. Thus, the nutritive salts of food so frequently lost in ordinary methods of preparation are readily restored by the concentration of the liquor in which meats and vegetables are cooked into a soup stock, as is practiced in almost every French kitchen. Again, the various fresh green vegetables used as salads yield in abundance these inorganic foodstuffs, the presence of which we have seen is indispensable to normal tissue activity. A further advantage of these and other succulent vegetables lies in the fact that their cellulose, while efficient in giving proper bulk and consistence to the stools, is, as compared with bran scales, soft and unirritating to the digestive tract.

From the facts, old and new, which have been presented, the following deductions appear to us justifiable:

I. The carbohydrates of bran are digested by man to but a slight degree.

II. The nutritive salts of the wheat grain are contained chiefly in the bran, and, therefore, when bread is eaten to the exclusion of other foods, the kinds of bread which contain these elements are the more valuable. When, however, as is usually the case, bread is used as an adjunct to other foods which contain the inorganic nutritive elements, a white bread offers, weight for weight, more available food than does one containing bran.

III. That by far the major portion of the gluten of wheat exists in the central four-fifths of the grain, entirely independent of the cells of the fourth bran layer (the so-called "gluten cells"). Further, that the cells last named, even when thoroughly cooked, are little if at all affected by passage through the digestive tract of the healthy adult.

IV. That in an ordinary mixed diet the retention of bran in flour is a false economy, as its presence so quickens peristaltic action as to prevent the complete digestion and absorption, not only of the proteids present in the branny food, but also of other foodstuffs ingested at the same time.

V. That, inasmuch as in the bran of wheat as ordinarily roughly removed there is adherent a noteworthy amount of the true gluten of the endosperm, any process which in the production of wheaten flour should remove simply the three cortical protective layers of the grain would yield a flour at once cheaper and more nutritious than that ordinarily used.

* An observation worthy of mention in this connection is that of Rubner, who finds that, while the presence of much woody fiber and harder cellulose in the intestinal contents induces the passage of stools containing an excess of undigested proteid foods, the absorption of fats under the same conditions is not materially affected.

Some Facts about Peppermint.

It may not be generally known, but it is nevertheless the fact, that the United States is the leading producer of peppermint and peppermint oil in the world. It is principally grown in the State of Michigan and in Wayne County, New York. Our production of the oil in 1878 reached as high as 150,000 pounds, but in 1883 the yield was computed at not more than 35,000 pounds. This year a larger acreage has been planted, but prices have advanced on account of the decreased stocks. The usual annual consumption of the world is about 100,000 pounds, but it is expected there will be a considerable increase this year, as also in other essential oils, on account of apprehension of cholera. Peppermint is grown to best advantage in good garden soils, but requires an abundance of moisture. An acre will grow plants enough to yield from eight to fifteen pounds of oil, according to the age of the plant and the locality, and the price is from $3.25 to $3.75 a pound. There are no large farms entirely devoted to this product, but it is cultivated in small quantities by many farmers. It is used in medicine, confectionery, and for perfumery, and is diluted with alcohol and water to make essence of peppermint. It is also largely used by sanitary engineers for testing joints and traps, a few drops poured in a wash bowl or closet making its presence sensible to smell at any imperfect joints in a pipe leading therefrom, its pungent odor not being apparently at all affected by the sewer gases. Peppermint is to a considerable extent adulterated with castor oil, oil of turpentine, and oil of pennyroyal, but these adulterations can be detected without much difficulty.

Freight Cars.

The rapidity with which freight cars are constructed at the Mt. Clare shops of the Baltimore & Ohio Railroad is quite remarkable, the *National Car-Builder* says. A gang of nine men can build a box car of the kind that is illustrated and described in the *Car-Builder*, in one day. A car has been built in nine hours, by as many men, but ten hours is considered the regulation time. In the old freight shops at this place there are four tracks for construction, and upon these four gangs of men turn out 24 cars per week. If more than this is done, the men are paid for overtime. The side and end frames are put together on the floor of the car, and then set up. The sides are set up in four sections, but without the plates. The plates are then lifted and held to the level of the girths by blocking sticks underneath. The plates have no holes in them for the rods to go through, but there are six castings bolted to the plates, and the rods are run through these castings, after which the stick is lifted upon the frame and driven into place. The end frames are then lifted, the corner posts put in place and pinned to the side frames. The whole end frame, like the sections of the sides, is framed separately and is set up in a few minutes. The use of castings and sill bolts makes this method of framing possible, and leaves the timbers solid where they would be the most weakened by boring holes. The bolt holes for the castings pass through the neutral axis of the timber, causing little or no diminution of its strength.

The specifications for these cars call for first class timber, the inspection of which is very rigid. An abundant supply of oak is obtained along the line of the road; it is of excellent quality, and the sources from which it comes are not likely to be exhausted for a good while yet.

The New England Institute Fair, Boston.

The fourth annual industrial exhibition of the New England Manufacturers' and Mechanics' Institute will open in Boston, Sept. 3. So far as can be judged by present indications, this year's fair will compare favorably with the highly creditable expositions which have preceded it. A specialty will be made of the agricultural and mineral wealth of the South and West and of Mexico, and New England industry in all its branches will be fully represented. Boston and its vicinity have many places pleasant to visit in the early fall, and these exhibitions have proved very attractive.

Atmospheric Changes at Nice.

Since the appearance of the brilliant sunsets, Messrs. Thollon and Perrotin have noticed that the sky at Nice seems to have lost much of its ordinary transparency. They have been accustomed, on every fair day, to examine the sky in the neighborhood of the sun, placing themselves near the border of the shadow projected by one of the observatory buildings. When thus sheltered from the direct rays of the sun, they have noticed in former years that the blue of the sky continued to the very borders of the solar disk. If they were so placed that the disk was almost a tangent to the border of the screen, but still invisible, no increase in the brilliancy of illumination indicated the place where the point of tangency would be found. This is now no longer the case. Since the month of November, even upon the brightest days, the sun appears constantly surrounded by a circular fringe of dazzling white light, slightly tinged with red at its outer edge, and with blue on the inner edge. There is a sort of ill-defined corona, with an apparent radius of about fifteen degrees. It would be interesting to know whether this fact is general, and whether it can be considered as connected with the volcanic dust or other causes of the late brilliant twilights.—*Chron. Industr.*

PORTABLE BARN.

The frame of the barn is formed of transverse sections, each of which is composed of a center post and two side posts, united by horizontal bars. The central top beam is mortised to fit tenons on the center posts, and its ends project beyond the frame, and are provided with short standards in which a long roller is journaled. The roller is turned by a pulley at one end. A piece of sail cloth, rubber, or other suitable material is secured at its middle to the roller. At the top of each side post is a notched bracket, in which the side top bars, which also project beyond the ends of the frame, are held. In the ends of the bars are journaled end rollers, each of which has a pulley and a piece of cloth attached to it.

KEYS & SLAUGHTER'S PORTABLE BARN.

A portable barn made after this plan can be erected or taken down very easily and quickly, and folded very compactly for transportation.

This invention has been patented by Messrs. B. C. Keys and A. J. Slaughter, of Murray, Ky.

Sewerage for a Town of 10,000.

The town of East Orange, N. J., population about 10,000, has lately introduced water, and is now about to put in a sewerage system. The water consumption is 300,000 gallons daily, and that is the estimated amount of sewerage to be disposed of. As this is an inland town, surrounded by several other cities, without communication with the sea, it is necessary to adopt some local method for the disposal of sewage. The engineer, Mr. J. J. R. Croes, has advised the sawdust filtration system, using the Farquhar-Oldham filter, with the addition of a small percentage of perchloride of iron. The peculiar construction of this filter will be seen by reference to the illustration in SCIENTIFIC AMERICAN SUPPLEMENT, No. 291.

The plan recommended includes a tight masonry receiving tank at the outlet, and a steam pump to lift the sewage 20 feet above the filter into another tank, where the perchloride of iron is added to deodorize the sewage; the discharge from the filter is clear and harmless.

To purify 100,000 gallons of sewage per day the tank and pumps are estimated to cost $3,000, and a filter, 8 feet in diameter, $3,000; 5 gallons of perchloride of iron, costing $1.50, and 60 cubic feet of sawdust would be required daily.

To purify 300,000 gallons per day the cost would probably be $15,000 for plant; the labor in both cases is estimated at $5 per day. The preparation of land for receiving the filtrated sewage and transmitting it to the streams would cost about $250 per acre; three acres of ground would suffice for the present demands of East Orange. Sub-surface irrigation, by laying a network of tile drains 10 inches under ground, would cost $2,000 per acre.

The approximate estimate for the entire sewerage of East Orange, as submitted by Mr. Croes, is $329,860, though much of this work would not be needed for some years.

Rain water is to be excluded. The estimate covers the laying of 40 miles of stoneware sewer pipes, calked with oakum and packed with cement.

SPRING SEAT FOR WAGONS.

The illustration herewith represents a way of holding wagon seat and similar springs in place, to prevent them from canting over when the wagon tips on sidehills or in passing over obstructions. The bars on which the ends of the seat rest are loosely connected with a stay bar, the latter passing down through keepers in the frame on which the springs rest, and also through keepers in the cross piece below. The bars on which the seat rests are rounded, and the stay bar is bent at the end below the cross piece to prevent its being withdrawn from its keepers. The loose connection between the stay bars and the bars on which the seat rests, with the rounding of the latter, tends to prevent the stay bars from being broken, while allowing the seat to move sufficiently in a lateral direction to ride easily over rough roads.

For further information relative to the patent which has been granted on this seat, address Mr. John Hodgess, Loyalton, Cal.

What Next?

The *Mechanical World* (London) makes the following invidious remarks respecting an American invention:

The resources of inventive genius are not yet exhausted in the United States, the writer truthfully remarks, and then he proceeds to say that some one who has probably heard somebody's grandfather remark that it is much more economical to supply boiler furnaces with heated air in preference to air under ordinary atmospheric conditions, has conceived the idea of heating the air before going to the furnaces by first passing it round the steam dome of the boiler. This is about the latest development we have met with of the notion of robbing Peter to pay Paul, and reminds one of the story of the four persons who went on an excursion and played cards all the way with such good luck all round that each one made his expenses for the outing. Probably the inventor has not reflected that if air be heated from 32° Fah. to 512° Fah. no chemical change would be effected, but its *bulk* would be doubled, and he would require to send twice the volume of air through his furnaces to burn the same amount of fuel. For example, if the oxygen of 300,000 cubic feet at atmospheric temperature be required for the combustion of one ton of coal, it would require that of 600,000 cubic feet if raised to 512°, a volume which, as C. Wye Williams points out, no natural draught would be equal to. Sir Humphry Davy tells us that by heating *gases* strongly which burn with difficulty the continued inflammation becomes easy, so that we have his testimony in favor of heating the *gas* rather than the air, and although he did not try the effect of heating the air and thus expanding it, he tried the effect of *condensing* it, and he ascertained that both "the light and heat of the flames of sulphur and hydrogen were increased in air condensed four times." But then Humphry Davy lived some time ago and is old-fashioned, and we shall expect next to hear that some other aspiring genius will have taken out a patent for heating the air by passing round the whole boiler before going to the furnace. Probably the best results will ultimately be obtained by combustion under pressure with heated air, for it is certainly true that the air must be heated before it combines with the fuel. How to do this successfully before passing the grate bars has yet to be solved.

The Mosquito's Instrument of Torture.

A writer in the London *Sportsman* thus describes a mosquito as seen under a microscope:

It appears that in the "bill" of the little beast alone there are no fewer than five distinct surgical instruments. These are described as a lance, two neat saws, a suction pump, and a small Corliss engine. It appears that when a "skeeter" settles down to his work upon a nice tender portion of the human frame the lance is first pushed into the flesh, then the two saws, placed back to back, begin to work up and down to enlarge the hole, then the pump is inserted, and the victim's blood is siphoned up to the reservoirs carried behind, and finally, to complete the cruelty of the performance, the wretch drops a quantity of poison into the wound to keep it irritated. Then the diminitive fiend takes a fly around just to digest your gore, and makes tracks for a fresh victim, or if the first has been of unusual good quality he returns to the same happy hunting ground. The mosquito's marvelous energy, combined with his portable operating chest, make him at once a terror and a pest.

Changeable Signs.

Make a wooden sign in the usual manner, and have a projecting moulding around it that projects one inch out from the face of the sign; now cut thin grooves into the moulding, one inch apart, allowing each cut to reach to the surface of the sign; in each of these grooves insert strips of tin, one inch wide, and long enough to reach across the signboard; when so arranged take out the strips of tin, and place them

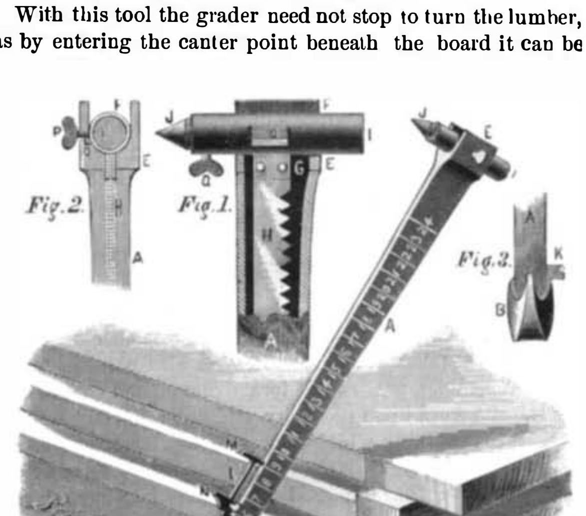
HODGESS' SPRING SEAT FOR WAGONS.

edge to edge on a level surface; paint any desired words on their united surface; when dry, reverse them and paint other words on the other side; now finish your lettering as usual on the signboard, and put the thin strips in correct order in the grooves; this will complete a sign that will read three different ways.

LUMBER GRADER'S COMBINATION TOOL.

Upon the lower end of a handle made of strong, tough wood is fitted a steel head, B, provided at one end with an ax blade and at the other with a canter, which is inclined toward the handle and has a chisel edge end. The other end of the handle is squared and is fitted with a metal band, across which and the end of the handle is formed a groove, from the bottom of which extends a recess into the handle. Fitting in the recess is a saw blade, H, provided with a tubular handle, F, that fits in the groove. At one end of the saw handle is a thumbscrew for holding a lumber lead, J, in place. At the center of one side of the handle is a flange, O, above which rests a thumbscrew in the band to hold the saw in place, Near the head upon one side of the handle, A, is a stud, K (Fig. 3), and upon the other side is a scale of inches. Upon one edge of this handle is placed a thickness gauge, consisting of a bar, L, having two prongs adapted to be driven into the handle, and having a finger, M, projecting upward from one end. Sliding upon the bar is a finger provided with a thumbscrew. Fig. 2 is a section through Fig. 1.

With this tool the grader need not stop to turn the lumber, as by entering the canter point beneath the board it can be



CALL'S LUMBER GRADER'S COMBINATION TOOL.

easily turned up for inspection. He can always stand over the center cross pieces of the pile of lumber, from which position the lumber can be easily handled. Frozen boards can be separated by a sharp rap with the point, D, at one corner of and between the boards. The gauge is for trying the thickness of the lumber, and may be set to any desired fraction of an inch. By placing the stud against one edge of a board, the width can be seen at a glance. The saw is convenient for trimming off the ends of boards, and the ax for chopping off ice and trimming off the stubs short.

Further particulars regarding this handy tool may be obtained by addressing the inventor, Mr. Jamas F. Call, of Clear Lake, Wis