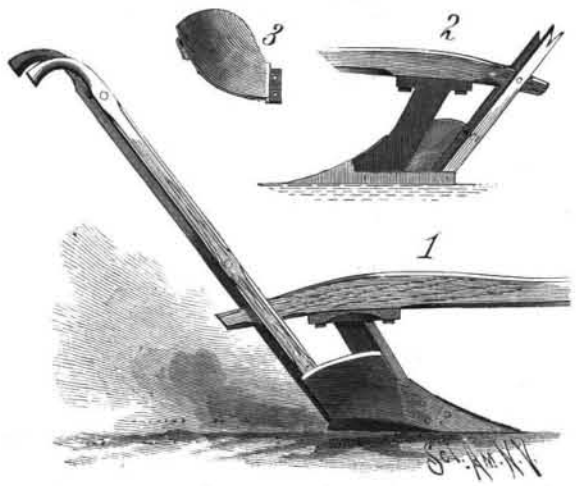
has been returned to a vertical position, the weights on the levers, G and H, will reset the parts, so that, by again moving the lever, an additional force may be applied to turn the wheels.

The braking mechanism consists of a rock shaft having arms carrying brake shoes. Rigidly connected to the shaft is a forwardly extending arm, L, which is coupled to the end of the lever, J. As the main lever is thrown to the right, the forward end of the arm, L, will be depressed, and the shaft rocked to carry the shoes against the wheels. The same mechanism operates brakes bearing against the rear face of the wheels.



NEVILLE'S COMBINATION PLOW.

Upon the main lever being returned, a weight carries the parts to their normal position. Further information concerning this patent, which is for sale, may be had by addressing the inventors, as above.

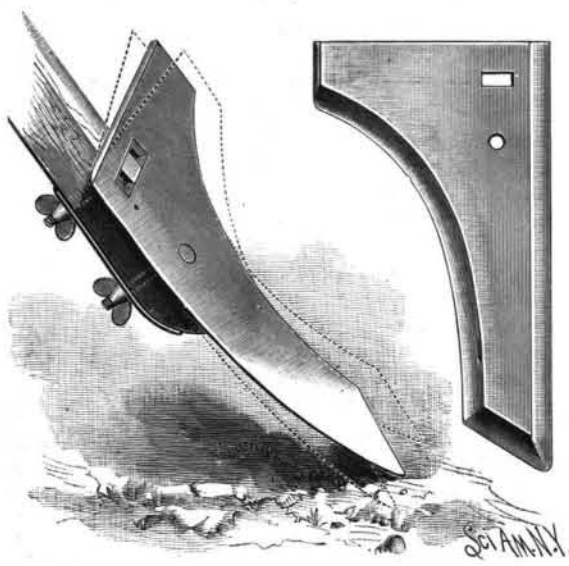
COMBINATION PLOW.

Upon the plow here illustrated either wooden or metallic mouldboards may be used interchangeably. The iron standard is bolted to the under side of the beam, there being a plate upon the upper end of the standard through which bolts pass. The standard projects downward and forward, and is provided with a flange, upon which rests the point, which is secured by a bolt and steadied by a rearwardly extending bar fitting in a recess in the standard, as shown in Fig. 2. Just back of the point is arranged a share, secured to the standard by bolts, and which projects upward beyond the flange upon the standard. The mouldboard, Fig. 3, has a flange fitting beneath the rear edge of the share, the extreme upper edge of the share abutting against a shoulder on the board. The handles of the plow are united by braces, one being beneath the beam; the landside handle is bolted to the rear end of the beam and to the rear end of the bar that steadies the point, while the lower end of the other handle is bolted to the mouldboard when the latter is made of wood. When the mouldboard is of metal, the lower end of the handle is stepped in a socket secured to the rear face of the board. Although a wooden mouldboard pulverizes the earth more thoroughly than one of metal, it is not always desirable to use the former, hence the need of a plow having interchangeable mouldboards.

This invention has been patented by Mr. S. S. Neville, of Burnsville, Miss.

CULTIVATOR TONGUE AND SHOVEL.

The engraving illustrates an invention which consists in a cultivator shovel, forming a combined tongue and shovel, capable of being adjusted laterally from a fixed



SANDERS' CULTIVATOR TONGUE AND SHOVEL.

center or pivot. The lower part of the blade, which is shown detached in the right hand view, forms the tongue part, while the upper portion forms the shovel. The straight vertical edge is beveled on its under surface to form a cutting edge, which adapts the blade to first plowings. The lower angular end is also beveled to form a cutting edge, and serves to work the earth closer to the plant. The end being made slanting, a forcing action is exerted toward or from the plant. The outer edge is straight below, but spreads out laterally and upwardly in a curve, and is also beveled. This construction provides for the surface of the ground being cultivated without disturbing the roots of the plant. Above the curved portion the edge of the blade is rounded, the object being to prevent injury to the plant. The blade is secured to a standard by screw bolts arranged one above the other. One of these bolts rests in a countersunk seat formed in the sides of an oblong slot running in the direction of the width of the plate, to provide for the lateral adjustment of the latter from a fixed center formed by the other bolt. This adjustment of the blade, shown by the dotted lines, enables the operator to plow either close to the plant or away from it.

The blade may be used either with its straight side next the plant, as when the plant is small and requires the earth stirred close to it, but does not require the earth to be thrown toward it; or the shovel may be turned so that its curved edge will be presented to the plant, when the roots will be left undisturbed and the earth thrown toward it. The sharp cutting edges permit the shovel to be readily shifted while in the ground, and hence it can be more easily managed than if the edges were square and blunt.

This invention has been patented by Mr. James M. Sanders, of Morrisville, Ohio.

COMBINATION TOOL WRENCH.

This tool may be used as a hand and pipe wrench, wire cutter, wire nipper, screw driver, tack drawer, measuring rule, and for other purposes. The flat circular ends of the arms are connected by a rivet. On opposite sides of the rivet the circular ends are formed with notches, the outer pair of which form wire cutting edges, while the corners of the metal at the side of the other pair are rounded, to enable the arms to grasp wire for the purpose of stretching it without danger of cutting it. One arm is curved near its free end toward the other arm, and its extremity

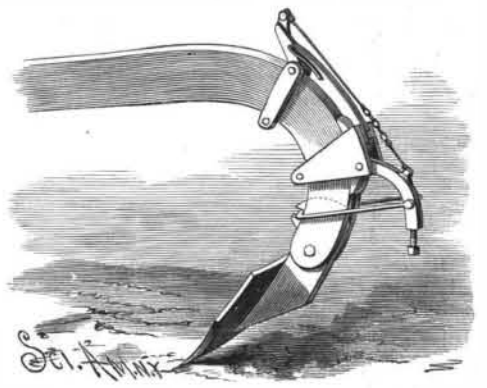
SPARHAWK'S COMBINATION TOOL WRENCH.

is provided with a chisel-edged angle hook, which is inclined toward the pivot. The other arm is thickened near its free extremity, curved outward and formed with sharp edged teeth inclined outwardly, and upon its extreme end is formed a screw driver edge. The inner faces of the arms are graduated into inches and fractions thereof, so that the device may be employed as a measuring rule. The hooked end is used for drawing nails and tacks and for engaging one side of a piece of pipe or a nut while being turned, the opposite side of the nut being engaged by one or more of the teeth on the end of the other arm. The screw driver is applied to a screw in the usual way, and the other arm may be employed as a lever for turning the screw. The arms fold compactly together, the screw driver edge coming directly opposite the edge of the hook. The outer corners of the arms are rounded, to permit of using the tool without injury to the hands, and also to prevent them wearing the pocket.

This invention has been patented by Mr. W. W. Sparhawk. Further particulars can be had from Mr. J. M. Marsh, of Scotia, Neb.

CULTIVATOR BEAM AND POINT.

The point shank is pivoted to the beam by a bolt. Attached to the beam is a spring, so arranged that it exerts a constant backward pressure upon the shank above its pivot. The spring thus holds the shank and point to their work until the pressure on the point overcomes the tension of the spring, when the point and point shank will spring backward and thereby lessen the pressure upon them. The lower end of the spring is attached to a yoke secured to the beam, and its upper end is held in a socket formed in a lever fulcrumed to a yoke on the beam, and is connected by a rod to a bent arm pivoted to the lower yoke. This arm is connected to the point shank by a coupling held in place by two lugs formed at the front edge of the shank above the point. In case the pressure upon the point is more than equal to the tension of the spring, the point will move backward, the shank moving forward. This movement will draw the bent arm forward and the upper end of the lever downward, and thereby increase the tension of the spring which, upon the removal of the pressure, will return the parts to their original position. In case of over-pressure, the ent arm will strike the back of the shank, and thus lock the lever and shank, so that no injury can be done the spring. The distance the arm moves is regulated by a set screw in its lower end. Should the point enter the ground too deeply or strike an obstruction, the shank will yield, so that the point will automatically run more shallow in the ground, or pass the obstruction



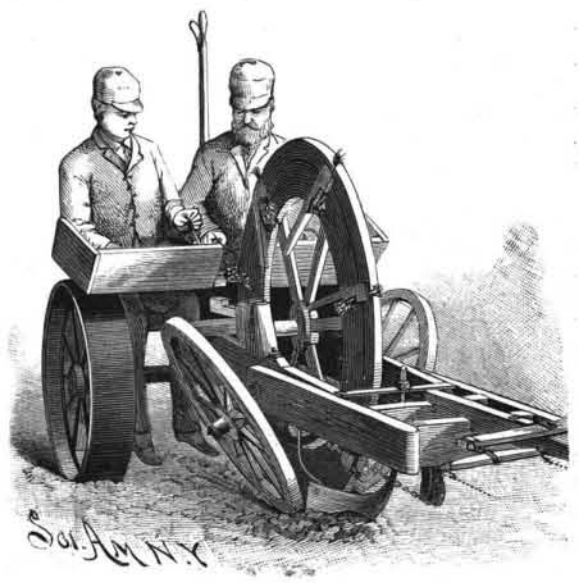
ADY & HAITH'S CULTIVATOR BEAM AND POINT.

without injury and without jerking the plowman or team.

This invention has been patented by Messrs. N. J. Ady and J. W. Haith, of Rockport, Atchison County, Missouri.

IMPROVED TOBACCO PLANTER.

The accompanying engraving illustrates a planting machine especially adapted for automatically setting tobacco plants, but also applicable for setting and resetting other plants or seeds. In the frame of the planter is journaled a large wheel which carries the plants to the ground. The forward end of the frame is supported by inclined wheels, which throw the earth back into the furrow and pack it around the roots of the plants. To the front of the frame is held the furrow-opening plow, which may be adjusted vertically to work at any required depth in the ground, and may be set nearer to or further from the plant-carrying wheel. The plow has a sharp nose portion to enter the ground easily, and has two rear wings which stand one at each side of the wheel to open a clean furrow somewhat wider than the tread of the wheel, and to protect the plant clamps, which are held to the right-hand side of the wheel rim. These clamps consist of clip blocks pivoted to lugs on the wheel, and pressed at their outer ends to or toward the wheel by springs. Behind the wheel is a plant-holding table having an opening, into one part of which the rim of the wheel enters, while in the other part is pivoted a plant-holding bed, upon which the plants are held in proper position to be seized by the clamps. To a hanger fixed to the frame is connected a plate, which is preferably elastic, against which the tails of the jaws of the clamps strike, to open them at the proper time for dropping the plants into the furrow. Another block, fixed to the frame, is so arranged as to open the clamp jaws as they rise to the table to grasp the next plant.



SIMMONS' IMPROVED TOBACCO PLANTER.

One of the clamps—the number of which is governed by the distance apart at which the plants are to be set in the ground—grasps a plant and carries it around forward until it is held, root downward, in the furrow. The clamp then opens, its tail striking the block, and the plant drops into the furrow, when the inclined wheels roll the earth back into the fur-

row and pack it around the root of the plant, the earth being packed by the wheels harder at the base of the furrow than at the surface. This way of packing the plants prevents them from being washed out by rains, and at the same time allows the necessary moisture to pass freely to the roots. The plants are set in a little ridge above the ground level, making it easy to plow closely when cultivating them. At times, on soft ground, one of the inclined wheels may be dispensed with, when the earth will be pushed back into the furrow by the other, the plow wings being so arranged that the one next the inclined wheel in use will throw out most of the earth. By means of suitable lever connections, the three forward wheels may be lifted in turning the machine.

This invention has been patented by Mr. Andrew A. Simmons, of Greenvale, Ill.

The Jetties in a Storm.

The construction of the jetties at the mouth of the Mississippi River has proved to be one of the works the most ingenious in its nature and most valuable in its results of all our public efforts. The success is to-day as obvious as the sunlight, and the stupidity, ignorance, hatred, and professional rivalry which once raged with furious bitterness against Capt. Eads are hushed, let us hope not without penitence and shame to the guilty and the foolish. At the very outset the army engineers opposed the project as one founded on wrong principles and impossible of success. The lucid and frank explanation of Capt. Eads they were as unable to comprehend as the negro who blackened their shoes —another instance of the imbecility that is so often engendered by red tape. Then came the "outlet theory," a system so unscientific and fallacious that one almost blushes to-day to think that so many Americans could be brought to countenance it. Then followed furious red-hot shot from a portion of the press, whose fitness and intelligence are shown by the crude criticism and shallow assertion they uttered, either from ignorance or spite.

The Cincinnati *Commercial* was the big goose that led the cackle, and a train of silly ducks quacked to the *Commercial's* music. If a single fact more than such as were known was wanted to confirm the confidence now felt in the jetties, the late storm in the Gulf has supplied it. It has often been asked how the jetties would stand one of those overwhelming tempests that sweep over the Gulf at intervals of years. Such a tempest we have recently had, and the jetties came out of the conflict with which the hurricane forces assailed them stanch and victorious. The storm went beyond any to which the jetties had been exposed, beyond even the noted hurricane of 1883. Not only did the jetties at the mouth of the Mississippi withstand the might of the storm, but those at the Sabine, not half finished, did the same. They are built on the same system as the Eads jetties, and the might that held out at the storm was the same fragile-looking willow mattresses that are used there. Major Heuer, who has supervision of the work, has carefully examined what effect it has had upon the unfinished work. The New Orleans *Picayune* reports that Major Heuer "found the Sabine jetties entirely uninjured, and no material change in the depth of the channel between them. They had withstood the fury of a storm that had swept away every human structure upon the adjacent land."—*Memphis Appeal.*

Health of European Cities.

The *Revue d'Hygiene* for October 20, 1886, contains an interesting article by Dr. Bertillon, the Chief of the Statistical Bureau of Paris, on the comparative healthfulness of the principal European cities for the year 1885, from which we take the following notes:

Typhoid fever was more frequent in the French cities than in others. At Rheims it caused, per 100,000 inhabitants, 151 deaths, at Marseilles 149, at Nancy 133, at Toulouse 79, at Havre 74, at Paris 63, and at Lyons 42. In Brussels the proportion was 19, in Amsterdam 11, in Munich 18, in Berlin 17, in Leipzic 16, in Konigsberg 38, Dantzic 33, Hamburg 32, Vienna 14, Copenhagen 8, St. Petersburg 90, London 17, Manchester 21, Liverpool 31, Edinburgh 34, Dublin 55. In New York the proportion was 26, Brooklyn 23, Baltimore over 38, and Philadelphia 64 per 100,000 inhabitants.

On the other hand, scarlet faver has been less fatalin France than in other countries, the only French city in which it caused a notable mortality being Marseilles, where it was 23 per 100,000 inhabitants. In Leeds it was 63, in Liverpool 33, Glasgow 56, Dublin 50, New York 40, Brooklyn 54, Philadelphia 39, Berlin 32, Dantzic 61, and Christiania 131 per 100,000.

For diphtheria the figures are, per 100,000 inhabitants: Marseilles 98, Amiens 113, Nantes 97, Toulouse 65, Lyons 25, London 22, Liverpool 23, Glasgow 22, Edinburgh 17, Manchester 6, Dublin 8, New York 94, Brooklyn 77, New Orleans 59, Philadelphia 62, Berlin 155, Dantzic 150, Dresden 142, Leipsic 137, Munich 71, Strasbourg 55, Stockholm 122, Christiania 434, and Copenhagen 57.

The cause of death, which is of great interest for purposes of comparison of the healthfulness of different localities, if accurate figures could be given, is consumption, or rather tuberculosis, since in such comparison it is desirable to reckon all the deaths due to tubercle, whether it affects the lungs, brain, or other organs.

Unfortunately, the reports are not so given that such a comparison can be made. A disease is by no means always contracted at the place of death. On the other hand, a certain proportion of those who contract this disease in a large city go to their old homes in the country or to various health resorts to die, thus making returns for cities necessarily inaccurate. Taking the figures as given, however, we find that for each 100,000 inhabitants there die from phthisis in Havre 494, Lille 463, Paris 453, Nancy 361, Rheims 340, London 205, Berlin 346, Breslau 361, Hamburg 309, Dresden 390, Leipzic 363, Munich 415, Nuremberg 475, Vienna 677, Buda-Pesth 642, St. Petersburg 553, New York 371, New Orleans 394, and Philadelphia 298.

Cure for Diphtheria.

Dr. A. Brondel writes, in the *Bulletin General de Therapeutique* of Nobember 15, 1886, concerning the treatment of diphtheria by benzoate of sodium, and asserts that of two hundred consecutive cases he has not lost a single one. He admits the possibility of a mistaken diagnosis in some instances, but, even excluding fifty per cent on this account, he still has one hundred cases without a death. His method is as follows: Every hour the patient takes a tablespoonful of a solution of benzoate of sodium, fifteen grains to the ounce, and at the same time one-sixth of a grain of sulphide of calcium in sirup or granule. In addition to this the throat is thoroughly sprayed every half hour with a ten per cent solution of benzoate of sodium. This is done religiously at the regular intervals, day and night, but no other local treatment is employed. No attempt is made to dislodge the false membrane, and no penciling nor painting of the fauces is resorted to. Tonics are given and antipyretics are used when occasion calls for them. The nourishment consists of beef juice, tender rare meat, milk, etc, but bread and all other articles which may cause irritation of the throat are forbidden. The sick room is kept filled with steam from a vessel containing carbolic acid, turpentine, and oil of eucalyptus in water.

The employment of benzoate of sodium is not a new method in the treatment of diphtheria, for it has been tried and is recommended highly by Letzerich, Kien, Ferreol, and others. But this, of course, speaks so much the more strongly in favor of the remedy, and as Dr. Brondel's results were better than those obtained by others using the same drug, it is to be presumed that his method of employing it is the best.—*Medical Record.*

Antidotes for Poisonous Chemicals.

Many serious accidents, says the *Moniteur des Produits Chimiques*, happen or may happen, in consequence of a loss of time in the application of remedies in the case or absorption of, or burning by, such poisonous chemical products as are commonly employed in the industries. The following antidotes are recommended: 1. For phenic, sulphuric, muriatic, nitric, or nitro-muriatic acids, creosote, tincture of iodine, or phosphorus, use the white of an egg well beaten up in water, and a teaspoonful of mustard in warm water. In case sulphuric, "nitric," or muriatic acid has been swallowed, it is necessary to take lime mixed with as small a quantity of water as possible.

2. For chromic acid, the chromates, and colors that have chromium for a base, the compounds of copper, and such preparations as have antimony for a base (such as tartar emetic), and the compounds of mercury and zinc, use the whites of eggs in abundance, and, as an emetic, mustard, which, however, is useless if the poisoning has been done by tartar emetic.

3. For ammonia, soda, potassa, the silicates, and the alkaline hydrosulphates, use vinegar and afterward oil or milk.

4. For prussic acid and its salts, the cyanides of potassium and mercury, the sulphocyanides, oil of bitter almonds, or nitrobenzine, pour water on the patient's head or spinal column, and put mustard plasters on the sole of the feet and the stomach. Do not let the patient go to sleep.

5. For ether, petroleum, benzole, fruit essences, and concentrated alcohol, take strong mustard as an emetic, with much warm water, cold baths, and fresh air. Keep the patient awake.

6. For the compounds of baryta or lead, use mustard as emetic, with warm water, Epsom salts or Glauber's salts in water.

7. For arsenic and its compounds, use mustard, and dialyzed iron with magnesia, and, afterward, oil, milk, or mucilaginous liquids.

8. For oxalic acid and its salts, use lime or lime water, and afterward castor oil.

9. For nitrate of silver, use kitchen salt dissolved in water, and mustard as an emetic.

10. For the nitrous fumes from the manufacture of nitrate of iron, or of sulphuric acid, take acetic acid, as strong as can be endured, in small quantities at a time.

Paste for Labels.*

BY LEO ELIEL.

The formulas here presented, with samples, are not original with the writer, but have been in use by him for many years with entire satisfaction.

1. Gum tragacanth	1 ounce.
" arabic	4 ounces.
Dissolve in Water	1 pint.
Strain and add Thymol	14 grains.
Suspended in Glycerine	4 ounces.
Finally add Water	to make 2 pints.

This makes a thin paste suitable for labeling bottles, wooden or tin boxes, or for any other purpose paste is ordinarily called for. It makes a good excipient for pill masses, and does nicely for emulsions. The very small percentage of thymol present is not of any consequence. This paste will keep sweet indefinitely, the thymol preventing fermentation. It will separate on standing, but a single shake will mix it sufficiently for use.

2. Rye flour	4 ounces.
Powd. acacia	½ ounce.

Rub to a smooth paste with 8 ounces of cold water, strain through a cheese cloth, and pour into one pint of boiling water. Continue the heat until thickened to suit. When nearly cold add

Glycerine	1 ounce.
Oil cloves	20 drops.

This is suitable for tin or wooden boxes or bottles, and keeps sweet for a long time.

3. Rye flour	4 ounces.
Water	1 pint.
Nitric acid	1 drachm.
Carbolic acid	10 minims.
Oil cloves	10 minims.
Glycerine	1 ounce.

Mix the flour with the water, strain through a cheese cloth, and add nitric acid. Apply heat until thickened to suit, and add other ingredients when cooling. This is suitable for bottles, tin or wooden boxes, and will not spoil.

4. Dextrine	8 parts.
Acetic acid	2 parts.
Alcohol	2 parts.
Water	10 parts.

Mix dextrine, water, and acetic acid to a smooth paste, then add the alcohol. This makes a thin paste, and is well suited for labeling bottles and wooden boxes, but is not suitable for tin boxes.

Roses for a Small Garden.

Twelve dwarf plants may consist of three Gloire de Dijon and one each of Chestnut Hybrid, Abel Carriere, A. K. Williams, Baroness Rothschild, Captain Christy, Charles Lefebvre, Duke of Edinburgh, Victor Verdier, and Prince Camille de Rohan. For walls, I should recommend Gloire de Dijon, Aimee Vibert, Belle Lyonnaise, Bouquet d'Or, Devoniensis, and Jules Margottin. In this selection of eighteen plants, I have suggested planting four Gloire de Dijon, for the reason that it is, without doubt, by far the best outdoor rose grown, and will produce during the season more satisfactory blooms for cutting than any other rose—which, to my mind, is the chief object. Devoniensis is a more beautiful flower, especially in the bud state, but then the proportion of bloom is about one to six. Aimee Vibert, with its vigorous growth and beautiful foliage, clad in summer with a canopy of snow-white blossoms, is very beautiful, but still not to be compared in usefulness to Gloire de Dijon, which from May until November yields blooms of excellent quality, shape, and perfume. As regards stocks, have them on the common brier, and plant low, so that they may form "own roots."—*J. K., The Garden.*

Arkansas Coal.

Much has been said lately in the local newspapers regarding the valuable resources of Ouachita County, Arkansas. The most valuable discovery made in this section is the vast deposits of brown and cannel coals. These coal beds are situated on the Ouachita River, running on a line with the river about fifteen miles north of Camden, nearly to the Little Missouri River, a distance of ten or fifteen miles overland in length, and thence running west about six miles. A number of drifts have been made in various localities where the coal cropped out, showing a thickness of the vein from two and a half to six feet. During the late war many barrels of oil were extracted from this coal. The ruins of the old government reduction works are yet to be seen near the banks of the river, but the old drifts have all caved in. The coal lies embedded in rugged, high, hilly lands, and the veins run in a horizontal direction at the base of the hills, so that instead of sinking shafts from the surface, all that is necessary is to run horizontal drifts from the base of the hills in the valleys, where outcroppings are discovered. It is easy coal to mine, is of a superior quality for fuel and heating and steam making purposes.

* From a paper read before the American Pharmaceutical Association.

Food Sophistications.

"There is no such thing in this city as the adulteration of articles of food, as a sanitary question," said Health Commissioner De Wolf, of Chicago, to an *Evening Journal* reporter who asked him to what extent our food supply was adulterated. "There is a sophistication of articles of food, and that sophistication is a commercial fraud, but that is all there is to it. The sophistication of cane sugar by glucose is not a sanitary question, for glucose is as healthy as cane sugar. The mixture of certain fruits with pepper berry to the extent of 8, 10, or 15 per cent is a fraud upon the consumer, but has no insanitary feature. So with the sophistication of all spices. The mixture of ground lemon shucks and ground cocoanut shucks with spices is commercially a fraud, but it does not affect the sanitary product. Coffees are sophisticated and adulterated to reduce the price, and the Rio coffee berry is by a process of roasting and polishing made to resemble the Old Government Java. Flours, the various preparations of oatmeal, and starch of all kinds, are neither sophisticated nor adulterated in any way in our city. The most our chemist finds in our milk is the addition of water or the removal of cream. There is occasionally found, however, in pickles, cooked and prepared for market, a slight trace of copper. This copper is used to give them the bright green tint. That is poisonous and is objectionable. It is probably true, also, that there have been times in this city within the last ten years when confectionery was colored with some salts which are highly objectionable, but I presume this custom has ceased. It is true, with the exceptions I have told you, there is no adulteration. It may be true that peas are used to sophisticate coffee.

"They make coffee berries out of them. That is getting to be quite an industry down in Connecticut, where they manufacture wooden nutmegs. That is a commercial fraud, but has no insanitary feature. I have heard, also, that honey was found in the comb in beautiful cuts, where neither the comb nor the contents had ever seen a beehive. The comb was manufactured out of paraffine, and the cells were filled with glucose, but that is not a sanitary violation. It is a commercial fraud, for honey is glucose. People prefer spices that are sophisticated. They won't buy and pay for spices that are pure. Some time ago a wholesale grocery firm sent out all through this community, at my request, spices that they guaranteed to be perfectly pure and free from any sophistication, and they only got one order, and that was from General Phil Sheridan. The rest of the people had rather pay nine cents a pound for pepper ground, when they know that the good berry cannot be bought for less than eleven cents, for they know that the adulteration doesn't hurt anything, and answers just as well. People in this city will not buy and pay for condiments which responsible firms guarantee to be free from sophistication. They prefer a sophisticated article at a lower price. In short, our great food products made up of the various preparations of flour, wheat, rye, oats, all our starches, and all kinds of flesh meat are perfectly pure."

Protect the Patent System.

All who are interested in patents should keep a watchful eye on Congress. At every session efforts are made to secure the virtual abrogation of the patent system, which, if not perfect in every respect, has aided in an important measure in placing the United States ahead of the rest of the world in inventions.

Just now the opponents of patents are urging the passage of Congressman Townshend's bill limiting the jurisdiction of the United States courts in patent cases and protecting innocent purchasers of patented articles. The advocates of this measure would convey the idea that the patent system is responsible for all the suits brought against infringers, and that infringers are an innocent set whom Congress should protect. This they would do by annulling the patents covering inventions which the public wish to appropriate without paying for them.

These persons say: "Certainly it is little enough for Congress to provide that such suits may not be brought against innocent purchasers, who act in good faith and with no notice or knowledge that the patent is an infringement." Such a sentiment may sound well to the thoughtless, but its absurdity is too apparent to escape notice. An inventor is not likely to devote years of thought and all his means to produce some great improvement which anybody may appropriate without rewarding him, unless, forsooth, he sends a messenger or writes a letter to every mechanic and every farmer in the country, to announce his discovery and warn them against appropriating the fruits of his genius.

The advocates of such a policy will next be saying that a man who has purchased a horse "in good faith and with no notice or knowledge" that it is stolen, should not be compelled to give it up; or that a bank should be compelled to cash a forged check because the person who presents it gave money or goods for it "in good faith and without notice or knowledge" that the check was forged.

The injustice of such a course is evident to all. Protect the inventor in his rights.—*The American Artisan.*

Celluloid.

BY SAMUEL P. SADTLER, PH.D., PROFESSOR OF CHEMISTRY, UNIVERSITY OF PENNSYLVANIA, U. S. A.

The material which is now generally known under the name of "celluloid," although known too as "zylonite," was first prepared by the English inventor, Alexander Parkes, about 1855, and introduced by him to the world under the name of "parkesine." His method at first consisted in preparing nitro-cellulose, or pyroxyline, by treating some variety of pure cellulose to a bath of mixed nitric and sulphuric acids, in which it undergoes the chemical change known as "nitration," and is converted into nitro-cellulose. Parkes then dissolved it in liquid solvents, like wood naphtha, mineral naphtha, nitro-benzol, or glacial acetic acid, and then driving off the solvent by evaporation, or precipitating the pyroxyline out of the solution as a semi-solid, curdy mass, which is then pressed and dried. Later, he adopted the use of an alcoholic solution of camphor for the solvent. Indeed, Parkes and his successors stated that all the ordinary volatile solvents are improved by the addition of camphor. Parkes abandoned the manufacture in 1867, on account of the difficulties in its manipulation, although he made a fine exhibit of his products at the Paris Exposition in 1867, obtaining a prize medal therefor.

Daniel Spill, also an Englishman, in 1869 revived the use of one of Parkes' methods, and, indeed, got a patent for the use of camphor or camphor oil, in connection with alcohol, as a solvent for the pyroxyline; but his American patent was afterward declared valueless by Judge Blatchford in a suit brought by Spill against the Celluloid Manufacturing Company. After the failure of Parkes, the first inventor, in making a merchantable article, no new discovery occurred in the matter until the Hyatt Brothers, then of Albany, N. Y., after considerable experimenting, found that solid gum camphor, when in the melted state, became a perfect solvent for the pyroxyline, so that, by thoroughly mixing the comminuted pyroxyline with camphor and heating, the mass became perfectly homongeneous and plastic. This discovery was patented in America, July 12, 1870, and reissued June 23, 1874, in an improved form, and constitutes the basis of the present manufacture by the Celluloid Company, of Newark, N. J. The only other manufacturers of similar products in America are the American Zylonite Company, of Adams, Mass., who were the defendants in a suit brought by the Celluloid Manufacturing Company for infringement of their patents, and against whom a decision was given by Judge Shipman, of the United States Circuit Court, in March, 1866, and reaffirmed in a second decision in July, 1866.

In England, the British Zylonite Company manufacture a similar product to that made by the American Zylonite Company, and, as I am informed, under similar patents. In France, there is only one manufactory of celluloid, at Staines-on-the-Seine, which is running under license of the Celluloid Manufacturing Company. In Germany, works were started by a Hanover firm, but were abandoned because of the explosive character of the material.

In the process of manufacturing celluloid, as carried out in America, a very pure form of cellulose is taken, preferably a tissue paper, which is prepared in large rolls by the paper mills especially to the company's order. This, after nitration, undergoes a thorough washing, and then a partial drying. To a weighed charge of this is added the necessary amount of camphor, and the two are then thoroughly incorporated and ground in suitable machines. A coloring pigment may also be added at this stage. The ground mass is then moistened with a small amount of alcohol, not that it is needed for solvent purposes, but merely to agglutinate it, and to allow of its being worked at a slightly lower temperature. It is then put into frames, and submitted to powerful hydraulic pressure for some time. The cakes so obtained are broken up, and the broken material is ready to be fed between the heated rolls, which are to complete the change of the material into what in the future will be known by the name of "celluloid." This is the celluloid "stock," as it may be called. It may be made transparent, translucent, dead white, or colored with a variety of pigments. It may be of uniform color and appearance, or it may be stratified and veined, so as to produce the imitations of ivory and amber, tortoise shell, coral, and ornamental stones. It may be rolled or cut into thin sheets, or it may be drawn into fine rods or tubing.

Its applications at the hands of the American Celluloid Manufacturing Company and their licensees are almost innumerable. Thus, among the earlier applications of this new material were the manufacture of celluloid brushes, combs, and hand mirrors, for which purpose it has almost completely replaced ivory and ebonite, as the celluloid brushes never lose their backs from immersion in water, nor do combs break by falling. They may be scoured and cleansed without fear of warping, and will withstand the chance careless usage of children. In the same way, celluloid collars and cuffs have been known for some years as excellent imitations of the best laundried linen, and possessing special advantages for travelers and tourists in the ease with which they may be cleansed.

But numerous applications have been found in the last few years for this material, some of which are, no doubt, destined to totally change the present condition of important industries. The very perfect imitations of ivory, amber, agate, and fancy marbles now made of celluloid have led to its use as an excellent material for the handles of knives and cutlery, as well as for umbrella and parasol handles and similar fancy articles. It is superior to ivory, in that it will not crack or become yellow with age, and to amber and precious stones in its ability to stand a sharp blow or fall. It is replacing ivory, moreover, in two quite dissimilar uses. It is used now almost exclusively in America in the manufacture of piano keys, as an entire key board can be finished to look perfectly uniform and true in shape and color—a thing extremely difficult with ivory, and, with the increasing scarceness of this material, likely to be more difficult in the future; and in the manufacture of billiard balls it has great advantages over ivory. It can be given any desired density and hardness, and its density will be absolutely uniform throughout the sphere, thus making the ball much truer in the hands of a skillful player.

Among the other applications of a more or less promising kind that have been found for celluloid in recent years, are the use of it for harness trimmings, as it stands exposure to snow, sleet, rain, and blistering sun, as well as frequent washing, and gold and silver e be worked in the ornamentation without the metal tarnishing by sulphur contact, an annoyance inseparable from other mountings; for the manufacture of emery wheels, which, with this material as the base, have proved to be superior in action and more durable than all other wheels; for covering corset steels, and trusses and surgical supporters; for plates for artificial teeth, in which use it has largely superseded hard rubber and metals, being stronger and healthier than the first and lighter than the second; in the manufacture of rims for eyeglasses, as they are light and strong, and do not rust or corrode; in the manufacture of letters for window and indoor signs, and of figures for street numbers; for veneering on wood in the manufacture of show cases and ornamental frames; and for various fancy articles, like furniture casters, etc.

An application that is now being developed is in the manufacture of stereotype plates for printing. Where printing is done on cylinder presses at high speed, durability and clear impressions have not been hitherto combined in one material. The difficulty has been that metal plates soon become illegible, and to replace them involved large expense. In these respects celluloid plates are much superior to metal. They give, when new, an equally sharp impression; when worn out, they can be replaced at much less cost, and, where emergency demands haste, they can be made in a part of the time required to put metal plates through the processes necessary to their production. One-half hour will suffice for casting and blocking a plate. The plates are light and convenient to handle. They are tough and elastic. Consequently they do not batter easily, like metal, and require no wrapping when sent through the post. This advantage is important, both as to saving of time and material in wrapping, and saving of postage in transmission. They take ink freely, and on cheap paper give a sharper impression than with the care ordinarily used by pressmen can be obtained from electrotypes. And for printing with colors, it is vastly superior to wood type or wood cuts. With celluloid a line may be worked in green or red, removed from the form, its face in a moment made as fresh as when new, and again immediately worked in another color. No time is lost in drying its surface, as it absorbs neither the lye, benzine, nor water. The celluloid adheres closely to the grain of its wood base, enters into its fiber, and becomes a part of the block itself, rendering detachment impossible. The rapid advances made in the application of this most interesting chemical product leave no room for doubt that it will play a very important part among the materials of construction in many manufacturing and technical processes in the future.

Top and Bottom Flanges of Wrought Iron Beams.

It is obvious that if twelve tons per square inch were the ultimate tensile strength of wrought iron, such beams should have the same quantity of material in both their upper and lower flanges. This is, however, not the case; the ultimate tensile strength is considerably greater—viz., nearly twenty tons—while the ultimate compressive strength is sixteen. The top and bottom flanges should thus be in the proportion of sixteen to twenty, or four to five, *i. e.*, the bottom flange should be four-fifths of the top flange for both to fail simultaneously, which is just the reverse of cast iron, where the lower flange is required to be six times greater than the upper on similar grounds. With wrought iron work, where riveted plates are used, the bottom alone is weakened by the rivets passing through the plates, the top remaining uninjured as regards compression, and on this account (neglecting the rivets in the calculation) little difference is practically made in the area of the top and bottom flanges of such girders.—*Edwin Clark, in the Architect.*