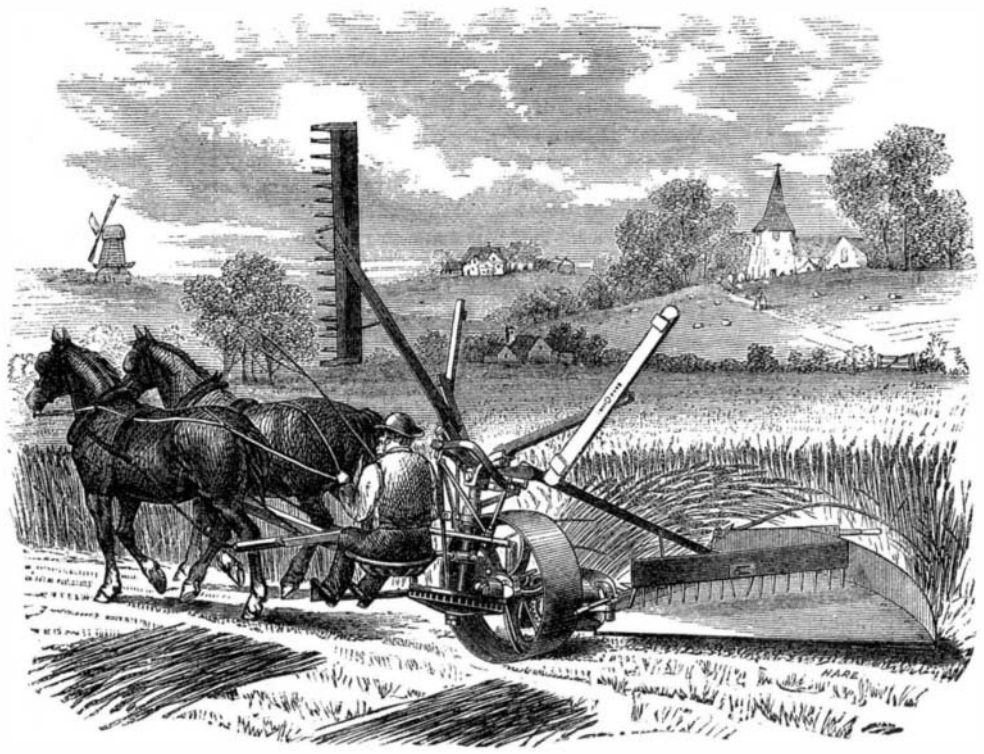
NEW REAPING AND MOWING MACHINERY.

We illustrate below some improved reaping and mowing machinery manufactured by Messrs Burgess & Key, London, England. No agricultural machine has had so much attention devoted to its improvement as the reaper and mower—especially the former. The difficulties under which such machines have frequently to work, coupled with the necessity that exists that the work shall be done in the very best and simplest manner, render it no easy matter to design a proper machine; and each year sees some new improvement brought forward at one or another of the various agricultural fairs. Owing, therefore, to these progressive strides, many excellent machines by various makers are now to be obtained at no very extravagant outlay of cash. Machines of this type are now made more compact, lighter and stronger, and, moreover, the dangerous parts are better protected and fenced in.

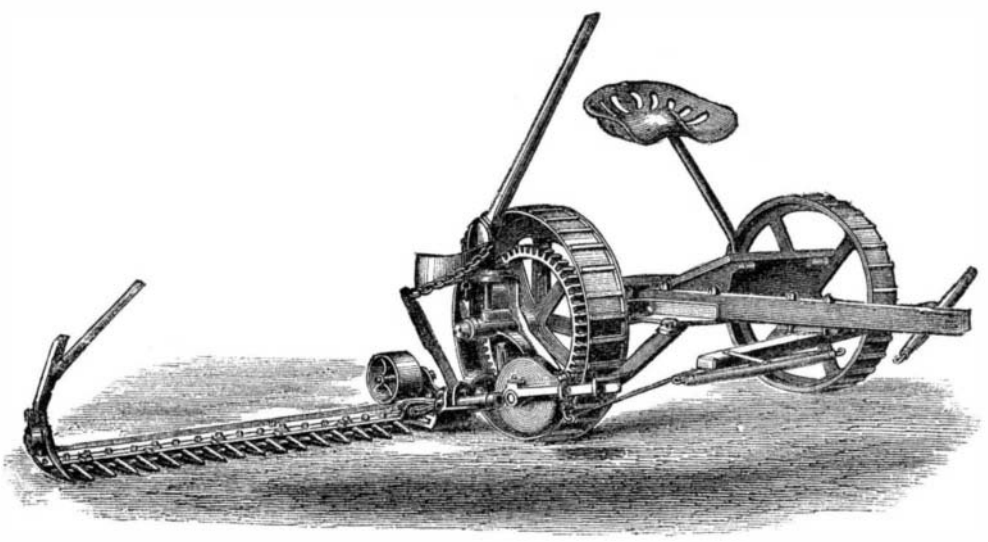
The reaper for home use shown in our first illustration is a strong two-horse machine, whose weight has been reduced down to 10 cwt.; the tyre of the main driving wheel is wrought iron and of extra width, which at once increases the driving bite and better sustains the machine in soft ground. The fingers, being open at the back, do not clog. The finger beam is made of rolled steel to combine lightness and strength, and the guide cam is so altered and improved as to bring the rakes closer to the ground, so as the better to deal with laid crops. The fingers, which of necessity are exposed to very severe and sudden strains, are now made of cold blast crucible iron, which is about the strongest description of cast iron to be had.



BURGESS AND KEY'S REAPER.

Our second illustration shows the reaper, in which increased simplicity and the substitution of wrought for cast iron have reduced the weight of the mower from 7¾ cwt. to 6¼ cwt., without reducing the strength, while the repairs bill is also reduced. The second improvement consists in giving the hinge shoe end of the cutter bar a greater space to rise and fall with the undulations of the ground, without disturbing the movement of the main wheel when it sinks in a furrow or in soft land. However carefully rolled, the surface will always present inequalities, therefore any provision to allow for them, such as the above, is of great importance. The cutter bar is provided with a wheel at each end, and the mechanism for elevating the knife is so designed that, by means of a compensating tongue and slide box, it is always kept parallel with the ground surface, and the fingers are thus kept from plowing into the earth. The method of lubrication is so designed that the oil applied to the bearings runs from them to the teeth of the gearing.

Another improvement is in the manner of jointing the knife to the connecting rod by means of a spring bolt pin. This pin secures itself, and no split pins, leather, etc., are needed; while any pressure of the thumb on the spring bolt at once releases the pin. A third improvement is in the method of inclining the fingers and recessing them so that the knife does not become clogged with dirt. In this mechanism, the crank shaft bracket not only secures the crank shaft bearings, but also the spindle of the bevel wheel, both bearings being bushed; and the bushes being the only parts that wear, they are easily and cheaply replaced in time of need. The bracket fences in the gearing and preserves it from dirt.



BURGESS AND KEY'S MOWER.

Paper Plants.

A good deal of interest has been excited by the recent reports on the paper-making grass of Algeria, the so-called *alfa* or *stipa tenacissima*, which covers hundreds of thousands of acres in that country. But the *Agricultural Gazette* of India states that another plant is to be introduced into Algeria, of still greater commercial value. This is the *hibiscus esculentus*, the use of which as a fibrous plant has long been recognized. The plant, though indigenous to the West Indies, has long been naturalized in India. Its pods produce the common vegetable known as ochro by the English, gomto by the French, chimtomo by the Spanish, and benditeai, in India, where it is so much esteemed for its mucilaginous thickening for soups. The pods are gathered green and pickled like capers. The seeds may be boiled like barley, and the mucilaginous matter they contain is both demulcent and emollient. They have also been recommended when roasted as a substitute for coffee. A patent has now been taken out in France for making paper from the fiber, and for this purpose it is to be introduced into Algeria. The fiber is prepared solely by mechanical means in a current of water, without any bleaching agent, and the pulp, washed and bleached, is reported to make a strong, handsome paper, equaling that from pure rags. It is called banda paper.

The Coffee Plague in Ceylon.

The Director of the Royal Botanic Gardens in Ceylon has just prepared a statement of the result of the latest investigations into the nature and development of the leaf fungus (*hemileia vastatrix*), which has for several years so affected the coffee trees of the island. He can report nothing to indicate its probable disappearance, or diminution of its intensity. Though requiring careful inspection for its detection, he unfortunately found it present upon all the coffee trees which he examined. With the help of a microscope, it is found at all times to pervade the greater part of the stem and older leaves in the form of very fine, branching filaments, its effect being apparent in numerous somewhat translucent spots, which may be observed by holding up one of the leaves against the light. The direct injury so caused to the coffee tree is, however, very slight as compared with the effect produced when the fungus attacks the young leaves, causing them to fall prematurely. As the presence of the fungous filaments in such abundance on the outer surface of the tree is amply sufficient to account for phenomena, which it was at first thought were attributable to a poisoning of the juices of the tree, by an absorption of the fungous matter through its roots, that idea must be abandoned, and the disease considered as external, except when it appears within the tissue of the young leaves. Subsequently, from these enclosed masses of filaments, short branches are produced, which emerge from the pores, and bear the conspicuous orange-colored spores, or reproductive bodies. Some of these spores have been observed to germinate on the outside of the leaf, producing branched filaments of exceeding tenuity, which grow with marvelous rapidity all over the surface of the leaf, and beyond it to the stems. The ends of some of these filaments, too, have been observed to enter the pores of the leaf, and there to form fresh plague spots and fresh crops of spores. It is to be hoped, now that the nature of the malady is better known and more accurately defined, that some effective cure may speedily be found for this disease, which is so greatly damaging the Cingalese coffee crop.—*London Grocer.*

Discovery of Another Grove of Great Trees in California.

This grove is situated in a basin at the head waters of the San Lorenzo and Boulder creeks. One of the trees eclipses all that have been discovered on the Pacific coast. Its circumference, as high as a man can reach, standing and passing a tape line around, is a few inches less than 150 feet. This is beyond the measurement of any tree in the Calaveras Grove. The hight is estimated at 160 feet, and a part of the top lying on the ground is over 100 feet in length. The other trees in the vicinity are not as large, but all are of immense girth.

A New Source of Fuel and its Utilization.

There is no doubt but that the cutting down of forest trees, simply for the sake of the wood as fuel, is a practice which cannot and should not be continued in any civilized country. The forests are far more valuable standing, inasmuch as their destruction, as we have repeatedly pointed out, involves climatic alterations and changes in the nature of soil which seriously affect agriculture. But the necessity for a cheap fuel, cheaper than coal, still remains; and probably until that want is supplied from other sources, no amount of warning and argument will confine people to using simply the dead wood and prevent their felling the growing trees. It so happens that there is a source for cheap fuel, which only waits for the invention of a means for its utilization. And this source is found in the grass which withers on the prairie, the seaweed which decays along the coasts, the dry leaves of the forest, and in all such vegetable refuse. If a quantity of straw, hay, or leaves be spread out in loose masses and set on fire, the result is rapid combustion; but if the same material be compressed into a solid bale or block, the combustion becomes little more than a gradual smoldering. It is hardly necessary to dwell upon these facts, since they are well known to every farmer who has transacted the slow burning of an old hayrick with the rapid ignition of the dry leaves, swept loosely together from roads and paths, and fired to get rid of them. In the latter case, there is a free draft through all the interstices of the mass, and hence an immense supply of oxygen; in the former the compression obstructs the draft, and checks the oxygen supply, and, as a necessary consequence, retards combustion.

It will naturally occur to the thoughtful reader at the outset that the needed invention must be one in the shape of a furnace in which the light materials may be burned in this compressed form. Western settlers have anticipated the idea by twisting straw and hay into ropes and burning the same during the long months of past winters, after the grasshopper devastations had deprived them of the necessary means wherewith to procure wood for their households. But this has proved but a partial solution of the difficulty, and the prairie grass ropes, though burning slower than the loose hay, are still consumed too rapidly to be of much advantage where a steady heat is required.

Whether a new invention which has recently appeared is to be the means of solving this important question, we are not prepared positively to state; but so far as the construction and principle of the same extend, it seems to be a valuable and ingenious device. It consists of a box of stove sheet iron, in which is a heavy press follower, which by simple mechanism can be moved up and down, and thus arranged to maintain a steady pressure upon the hay or similar material placed in the fire chamber. A feeder allows of the supply of fuel being kept constant, and there is apparatus for adjusting the grate relatively to the follower, according to the quantity of material placed between them.

It will be readily understood that, when the pressure is upon the fuel, the flame cannot act upon the mass either at top or bottom. Combustion, says the inventor (Mr. Alexander Hamilton, of Cresco, Iowa) can go on only around the sides to which the heat and air have access; so that the consumption of fuel is very slow, and can be easily graduated by the draft supplied. It is further said that one hundred pounds of hay or straw per day will be sufficient to feed the stove during the coldest weather, and that six or seven tuns of the material will suffice for an entire winter.

If the invention substantiates in practice the advantages foreshadowed, it will serve at least as a step in advance foward a most important utilization of a now wasted material, and at the same time it will accomplish such progress certainly in a mode much simpler than that involved in the majority of straw-burning furnaces now extant.

New Inoxidizable White Metal.

According to M. Marlié, an inoxidizable white metal may be made of iron 10 parts, nickel 35 parts, brass 25 parts, tin 20 parts, and zinc 10 parts. The alloy is cast and cut in pieces, and the latter are tempered at white heat in a mixture of sulphuric acid 60 parts, 1 nitric acid 10 parts, muriatic acid 5 parts, and water 25 parts.

AN obdurate screw may sometimes be drawn by applying a piece of red hot iron to the head for a minute or two, and immediately using the screw driver.

Russian Metal Industries.

While Russia will not through her government contribute to the Centennial, for reasons about which there are so many contradictory rumors that it is difficult to assign any as the truth, there is a fair probability that through private enterprise her industries will make a display which will, in a measure at least, typify her enormous natural resources. In the United States, little is known concerning industrial progress in Russia, other perhaps than that the advancement of the same must necessarily have been rapid, in view of a great civilized empire to-day existing where, one hundred and fifty years ago, there was little more than a nation of barbarians. From the death of Peter the Great in 1725, Russian manufactures have steadily pushed onward, until now in several branches they enter into competition with those of far older countries.

In some districts the manufacture of cutlery and hardware forms the sole occupation of the entire male population. A kind of two-bladed pocket knife is made, at the rate of 10,000 dozen per year, and sold at the annual Fair of Nijni Novgorod. Locks and trunks manufactured in the Pavlovo district find their way all over Asia. Some thirty or forty settlements in the Pavlovo district make nothing but knives, scissors, swords, and various edge tools. There are two large firms which employ 600 men each. The raw materials are English steel and a native product obtained from the government works on the Ural River. A large portion of the Semenoff district is engaged in the manufacture of fishing tackle and metal bolting cloth for mills, and 40,000 scythes per year are made at the Artinsky works in the Zlatoust district of the Ural. The Russian edge tools differ from those of English make in many respects. The common spade, for instance, is made chiefly of wood and simply tipped with iron; it is of small size, rounded at the edge, and has a plain curved handle. The ax is much larger than those of western manufacture. In the hand of a Russian workman, it is used for all kinds of carpenter's work. It answers as a plane, and as a hammer; even as a saw, for the last very useful tool is rarely employed by the Russian mechanic. He can wield the ax more easily, and cut through thick logs of wood with incredible precision and rapidity.

Russian iron is now largely employed in the cut nail manufacture, a growing industry carried on near Moscow. Silesian and Swedish irons are made into telegraph wires. The manufacture of iron holds a very important position, although the quantity produced is insufficient to supply the demand; besides, Russia is unable to compete in the cheaper qualities of that metal, owing to the expensive process of using wood fuel in its manufacture, coal being rarely used. Sheet iron is produced to a great degree in large private establishments; but steel-making is yet in its infancy, the metal being made almost entirely by one or two government founderies; it is applied chiefly to the manufacture of cannon. Breech-loaders, introduced by the Americans and adopted in the Russian army, cartridges, and swords are manufactured also by government works.

Colonel Amosoff, of the Zlatoust Government Works in the Ural, has discovered, it is said, the secret of the ancient Damascus steel. The Russian imitation is a particular modification of cast steel of peculiar crystallization, which last character betrays itself through corrosion by acids (the process of bringing out figures on steel) by acting more violently between the interstices of the structure than elsewhere, thus tracing out the arrangement of the crystals. The sword blades are made to pass a test, being bent double and back again several times. A well tempered saber of Damascus steel will readily sever bars of iron and the most flimsy kerchief as it floats in the air.

Samovars are a leading article of the Russian metal trade. These are a kind of tubular boilers, with little charcoal furnaces, and are used for making tea. The material is copper, which is almost exclusively used among the well-to-do classes for cooking utensils. Tin ware, hollow cast iron vessels, and pewter are little employed. The peasants still eat with wooden spoons and bowls.

Harness fittings of European pattern are made, but in very limited quantities, those used upon Russian harness being of different construction. Horseshoes are produced by hand at the rate of 30,000,000 per year. Bell-making is carried on with especial success, the bells being remarkable for the immense size and richness of tone. This is one of the ancient industries of the country.

It may be said, writes a correspondent of the *Ironmonger*, to whose exhaustive letter we are indebted for the main facts given above, that Russian manufactured goods have for the most part attained a high degree of excellence; but many of them are enormously dear. The interests of the immense mass of the Russian people who consume are thus sacrificed to increase the wealth of the comparatively small class who manufacture. But it must be remembered that the greater number of iron-manufacturing consumers were only a few years ago in a state of serfdom.

Patented Car Improvements.

The mechanical requirements of railroads are a perpetual stimulus to invention. An unceasing demand exists for new or improved devices. The two great essentials of safety and economy are never so perfectly realized as to satisfy either the road managers or the public. The burden of nearly all the talk when engineering and mechanical associations meet for consultation is how to remedy existing defects by the use of better methods and appliances. This, with the inherent capacity of railways for development, offers an inviting field to inventors, which they have not been slow to cultivate. The consequence is that a multitude of inventions are pressed upon the attention of railroad men, some of which are intrinsically good and meritorious, while the vastly greater number are absolutely worthless. But so long as inventors persist in patenting the products of their ingenuity, railroads must pay for the right to use them, or not use them at all. A discrimination must also be made, in order to select such as are really valuable; and this can be done in no other way than by careful experimental testing, uninfluenced by the interests or claims of patentees.

The discussions of the Car Builders' Association at its last and previous meetings evince a sensitiveness on the part of some of the members in regard to the use of patented devices, which is not calculated to secure the advantages to be derived from them. The impression seems to prevail with some that such devices are not only inadmissible as legitimate topics of discussion, but that the many needed improvements in the construction of cars must be provided, as far as possible, without paying tribute to inventors. Now this would unquestionably be a very good thing for the roads, if it were at all practicable. There is, however, a very serious obstacle in the way of carrying out such a programme. Inventors, as a class, are no exception to the general run of humanity. They are quite willing to receive remuneration for the time and money they expend in getting up good and useful contrivances for making cars run easily and comfortably. If they have anything to sell which is salable, they do not blush to name a price; and they would just as soon make a livelihood out of railroad earnings as in any other way. It is purely a business transaction between buyer and seller. In this view of the case, it is evident that no very valuable improvements in the design and construction of cars are likely to be discovered and applied independently of patents and patentees. It would, therefore, seem to be right and fitting that all patented inventions for such purposes should be freely discussed by car builders at their yearly and monthly meetings, as the only way of ascertaining what is worthy of being adopted. Any practicable plan for better ventilation, any radical improvement in drawing and buffing attachments, brakes, framing, coupling, etc., must work a saving in expenditure, or augment the comfort and safety of passengers to a degree which will more than justify the cost of the right to use, or else such improvements are hardly worth a trial.

We are aware that there is a difficulty attending the discussion of the merits of rival inventions, or, indeed, any patented invention having relation to cars. If this, that, or the other device is approved or condemned, a suspicion is apt to be aroused that undue influences have been brought to bear, that somebody's ax is being ground, or somebody's fortune made or unmade, while others, equally worthy or unworthy, do not get what is their due. It is hardly possible that entirely disinterested action can be secured in such cases; but action of some sort cannot very well be evaded. It is obviously not the business of the Car Builders' Association to make or unmake the fortunes of inventors, or to discriminate between rival claims, except on the score of actual merit; but it is certainly bound to recognize inventions, and pass upon their respective merits, so far as the interests of railways within the limits of the car departments are affected thereby.—*National Car Builder.*

American Ordnance.

The low estimate placed by Europeans upon cast iron as a gun metal has not been fully concurred in by American officers, who have made it a subject of investigation and careful experiment for many years. Since 1840 a steady progress has been made in the improvement of its qualities, and the experiments of Wade and Rodman in this direction are well known. There can be no doubt that the American gun iron is the strongest and best cast iron made in the world. The mean tenacity of the metal of the 15-inch guns made during the war was about 36,000 lbs. per square inch, and in some cases reached 40,000 lbs. The iron is smelted in small charcoal furnaces with cold or moderately warm blast, and from pure rich soft limonites. The crude pigs are subjected to one and sometimes two preliminary meltings in an air furnace with sand bottom. The guns for the army are cast hollow, and cooled from the interior by a water core, while those for the navy, with the exception of the 15-inch, are cast solid. A wood fire is kept up in the pit for several days during the cooling. The water core is at length removed, and water is circulated in the naked bore until the gun is quite cold. The initial tension thus produced is considerable, though in very rare cases excessive. The degree of tension is determined by cutting off an annulus from the sinking head or muzzle and planing a radial cut. Just before the cut has passed through the annulus, the ring snaps, and the amount of gape gives the relative tension. Guns which do not conform to the requirements of these tests are rejected.

The only gun in the United States service upon which much reliance has been hitherto placed, and which is capable of really heavy work, is the 15-inch smooth bore. There are innumerable smaller guns mounted along the sea coast, but they are each considered as a *locum tenens* awaiting a heavier armament. While the 15-inch smooth bore is very far inferior to a 10-inch rifle in range and in penetrating power against heavy armor, it is by no means an insignificant weapon. This gun was designed in 1867 and 1868 to fire a maximum of 50 lbs. of powder and a 350 lb. shell, but its present charge is a solid shot of 450 lbs., with a maximum of 120 lbs., and a service charge of 100 lbs., of powder. The muzzle velocity with the heavier charge is about 1,700 feet, with the lighter about 1,590 feet, while the corresponding pressures, as recorded by a Rodman internal gage, are 21,000 lbs. respectively.

This great increase in power points of course to a great improvement in the means of controlling the action of the powder. Experiments upon gunpowder have been very numerous and thorough in the United States indeed we may say that that country is not behind any other nation in this respect. From the experiences gained, the experimenting committees have settled quite definitely for the present the gunpowder which will be used, and with the results obtained they appear quite satisfied. We are not at present in a position to publish the exact details respecting the powder recently adopted into the service, but we may state in general terms that the new powder is a large pellet consisting of two truncated hexagonal pyramids, base to base. They are pressed into this form between bronze plates which contain cavities, corresponding to the truncated pyramids, arranged in honeycomb fashion. The powder comes out in large sheets, which are easily broken up into pellets. There is nothing in this particular form of pellet, except that it is the most convenient for making, easily and cheaply, a powder which fulfils the following conditions:

1. The grains must be of sensibly uniform size and shape.
2. They must be homogeneous in respect to density; not only must the density of each and every grain be the same, but there must be no hard and soft portions in any single grain.
3. The ratio of surface to mass should be as small as practicable
4. All angles should be as obtuse as possible.

This shape of grain apparently fulfils the foregoing requirements better than any other which has been devised, excepting possibly the prismatic, to which, however, it appears to be equal, and is certainly cheaper and more convenient to manufacture. It is called the hexagonal powder, and its most satisfactory features are very low pressures with good velocities and remarkable uniformity of action. In the 15-inch gun the variations of pressure are not worth mentioning, and under the constant pressures of 15,000 lbs., or even 20,000 lbs., the endurance of these guns would be practically indefinite. The Rodman internal gage for recording pressures is exclusively used in the United States, where it is much preferred to Noble's crusher. The latter, indeed, appears to be strongly condemned among the artillery officers of the United States, although they are fully alive to the imperfections of the former. The gage ordinarily used consists of the well known cutter placed in a cylindrical steel box, the piston rod being exposed by a hole in the cover The whole is tied to the bottom of the cartridge bag, and buried in the powder. It is usually left in the bore after the discharge, or drops in the sand a yard or two from the muzzle. Sometimes the external gage is used in connection with it, and, notwithstanding the prevailing belief to the contrary, the two gages show a very reasonable agreement.

In consequence of the increased powder charges employed, buffers have been introdnced into the American carriages, for the fifteen inch gun with 100 lbs. of powder is very lively on its carriage. For some years a pair of cylinders fixed to the front end of the chassis have been employed; they are a little less than 8 feet long and 13 inches diameter, and the recoil pulls out the piston rods compressing the air in the cylinders. They work very well, but are bulky and costly, and experiments are being made with hydraulic buffers, similar to those in use in this country.

The instruments for recording velocities in use in the United States are the Schultz and Boulengé's chronographs, the one most frequently employed being the former. This (the Schultz) instrument has been almost abandoned in Europe but in America it is supposed to have failed here through want of skill in its use, for when well handled it is a very superior instrument. United States' artillery officers have become so thoroughly accustomed to it that they generally prefer it, though the Boulengé and Benton chronographs are often used for "rough and ready" work —*Engineering.*

Useful Recipes for the Shop, the Household, and the Farm.

[We desire to state that the recipes which are given herewith, as well as those which have appeared in our columns from time to time, are not vouched for by us as absolutely correct, since it is manifestly impossible for us to submit all or even a fraction of them to the test of personal experience. They are selected, however, with much care from a wide and reliable range of sources, both domestic and foreign. Many are kindly furnished us by correspondents, and such we are especially gratified to receive. In this connection, we beg again to remind our readers that our columns are always open to them for the publication of such results of their own observation and experience as they may be pleased to communicate. We cannot repeat old facts, nor present trivial ones, but there is hardly a person who may read these lines who cannot send some hint or suggestion, sure to be new and valuable to some one else. Never mind the writing or the spelling; send us the bare facts, and thus pay off the moral debt owing to those who have already contributed their knowledge for your benefit. We intend this column of recipes especially for such suggestions; and if every one of our subscribers will but contribute one good fact a year, a volume of this paper will contain 45,000 recipes and valuable suggestions, not obtainable in books or from any other source.—EDS.]

Yellow stains commonly called iron mold are removed from linen by hydrochloric acid or hot solution of oxalic acid. Wash well in warm water afterward.

To fasten emery to leather, boil glue very thin, add a little milk, raise the pile of the leather, and put on the glue with the brush. Then sprinkle on the emery, and let it cool.

To preserve soap grease, fill a cask half full of good strong lye and drop all refuse grease therein Stir up the mixture once a week.

The best fattening material for chickens is said to be Indian meal and milk.

A remedy for caterpillars, which is used on a large scale in France, consists in a solution (1 part in 500) of sulphide of potassium, sprinkled on the tree by means of a hand syringe.

The best and most durable insulation for electric wires is to tin them and cover with pure rubber.

Javelle water, used for turning white the dirtiest linen, and removing stains, is composed of bicarbonate of soda 4 lbs., chloride of lime 1 lb. Put the soda into a kettle over the fire, add 1 gallon of boiling water, let it boil from ten to fifteen minutes, then stir in the chloride of lime, avoiding lumps. Use when cool. This is good for removing fruit stains from white underwear.

Biborate of soda dissolved in water, used as a lotion, will remove prickly heat.

The average yield of corn cobs is 7 62 parts of carbonate of potash in 1,000 parts of the cobs, which is nearly twice as much as is furnished by the best specimens of wood. The corn crop of this country will supply 15,400,000,000 lbs. cobs, from which 115,500,000 lbs. of potash might be made.

The way they boil rice in India is as follows: Into a saucepan of 2 quarts of water, when boiling, throw a tablespoonful of salt: then put in 1 pint rice, previously well washed in cold water. Let it boil 20 minutes, throw out in a colender, drain, and put back in the saucepan, which should be stood near the fire for several minutes.

Save the corn cobs for kindlings, especially if wood is not going to be plentiful next winter. To prepare them melt, together 60 parts resin and 40 parts tar. Dip in the cobs, and dry on sheet metal heated to about the temperature of boiling water.

Equal weights of acetate of lime and of chloride of calcium, dissolved in twice their weight of hot water, is a fireproofing mixture for fabrics.

The ammoniacal solution of oxide of nickel will dissolve silk; that of copper dissolves cotton also.

[For the Scientific American.]

THE CHEMICAL FIRE-FLY.

BY PROFESSOR C. W. WRIGHT.

Of all the elements, there is none which presents such a diversity of forms as phosphorus, and not one that presents such a variety of properties which are so apparently contradictory. The number of allotropic forms assumed by this element, and the peculiar part which it plays in the conditions essential to the manifestation of sensation and intelligence, together with the fatal effects which often result from its introduction into the system, give it an interest not exceeded by that of any other form of matter whatever. A distinguished professor of this city, who was in his day a most attractive teacher, maintained that the chief element of success in a lecturer consisted in the power to address the eye, experimentally when possible, and by a well drawn mental image when the subject under discussion did not admit of physical demonstration. In other words, he contended that nothing should be left to the imagination of the student. There can be no doubt that a single, well selected experiment, skillfully executed, is more instructive than an hour's talk without illustration. Phosphorus may be selected as a means of illustrating the two methods of presenting a subject. Thus, the average text book informs the reader that phosphorus is luminous in the dark, or, in other words, phosphoresces when exposed to the air; and this is about all that is stated in reference to a property of this element, which is the most important of any connected with it. Upon this property, or one closely allied to it, is the poisonous quality of this agent based. Destroy this power of phosphorescence, and this element is no longer a deadly poison, either when swallowed, or by the action upon the bones of the upper and lower jaw. The phosphorescence of this element is accompanied by the development of ozone, and any substance which has the power of destroying ozone will arrest the luminosity of phosphorus, and, what is of still greater importance, destroy its poisonous action. In fact, phosphorus is not of itself a poison, but the ozone which it has the power of developing out of the oxygen of the air is the sole cause of the fatal results which follow its introduction into the system. This I have repeatedly demonstrated by experiments on the lower animals; and in two cases of accidental poisoning in human beings, the same facts have been proven. This is a subject, however, that properly belongs to the medical profession, and I will simply state that ten or fifteen drops of spirits of turpentine, mixed with an ounce or two of sweet oil, or any liquid fat, will prove an efficient antidote to elementary phosphorus, or any substance, such as the tips of matches or certain rat poisons, with which it may be incorporated. Other volatile oils, such as sassafras, may be employed when turpentine is not at hand. It is not every specimen of turpentine that will prove antidotal to phosphorus. Any substance that has the power to instantly destroy the luminosity of this body will prove effectual as an antidote; and the only assurance we have of the efficiency of any agent is to test it beforehand.

Phosphorus is, then, not of itself capable of producing inflammation of any tissues of the body; but ozone, which it has the power of evolving from the oxygen of the air, is the cause of all the local mischief which results from its contact with certain parts of the body. That this body may produce certain general effects when it finds its way into the circulation, we do not doubt, but these are distinct from its local action.

To prepare the chemical fire-fly, by which some of the most characteristic properties of phosphorus can be demonstrated, select a two ounce phial which has been well annealed, and introduce into it sweet or almond oil, till the bottom is covered to the depth of half an inch (lard will answer, if nothing better can be procured), and to this add fifteen or twenty grains of phosphorus, and then cork it loosely. After this, place the phial in a pan of cold water, and set it on a stove or other warm surface till the phosphorus melts, then shake the phial till the oil has dissolved as much of it as it is capable of holding in solution. Three or four vigorous shakes in the course of ten minutes will answer. That quantity of oil will not dissolve the whole of the phosphorus, which is not desirable. The cork must not be a closely fitting one, but must be forced into the phial so as to nearly prevent the escape of the oil when inverted. It is best to give the cork more of a conical shape than those in use by druggists. When experimenting, the phial must be warmed about as hot as the hand can bear, and slightly agitated or inverted, taking care, when doing this, to have the cork well secured; it may afterwards be loosened a little. When the cork is properly adjusted, which can be easily accomplished by a little practice, the whole interior will light up every few seconds, in rhythmical succession, and continue to do so for hours, provided the proper temperature is maintained. At the conclusion of the experiment, the apparatus should be put away in a dark place, and a tightly fitting cork introduced into the phial. A number of these phials, properly adjusted in a darkened room at different points, and several set swinging by means of strings suspended from the ceiling, produce a singular and weird impression, that grows upon the observer the longer the experiment is observed; and after a time it is difficult to divest oneself of the idea that the light is evolved by a living, moving creature. For impressiveness, there is no experiment in chemistry that makes such an enduring image upon the observer. Of course every precaution should be taken to avoid breaking the apparatus or spilling the oil. No damage, however, need be apprehended provided the directions are strictly followed. In experimenting with phosphorus, the inexperienced should always be provided with a large vessel of water in which a few drops of turpentine have been diffused. When burning phosphorus has been extinguished by this water, there is little or no danger of its re-ignition, which is very apt to occur when it is extinguished in the ordinary way. The phosphorescence of this element, when a solution of it is spilled upon any object, as well as its disagreeable odor, are instantly destroyed by a small quantity of turpentine suspended in water.

Under no circumstances should children or careless persons be permitted to experiment with phosphorus; not that it is anything like as dangerous as coal oil and many other articles handled daily, but there is no substance that so completely demoralizes the understanding, in case of an accident, as this.

The glow-worm may be imitated by transmitting bubbles of air through glass tubes containing the phosphorized oil. In fact, there is no end to the number and variety of experiments that can be devised by a person of inventive genius.

The phosphorescence of the fire-fly and glow-worm is due to slow combustion or oxidation; and the phenomenon is arrested in them, as it is in phosphorus, by placing them in a negative gas, such as nitrogen, for example. Phosphorescence is not always, however, the result of oxidation. This fact can be demonstrated by exposing the diamond to direct sunlight for a few minutes, and then transferring it to a darkened room, when it will emit a beautiful light for several seconds.

The phosphoresence of the fire-fly is not due to the slow combustion of phosphorus, nor is it an amatory display on the part of that insect. The species are perpetuated under different circumstances, and in the daytime. The fire-fly is a carnivorous insect, and the object of the illumination is to attract small insects, which are quickly devoured.

If the ear be placed near the vessel of phosphorized oil at the moment of illumination, a slight hissing noise will be perceived, produced by a sudden rush of air into the phial, in consequence of the partial exhalation (one fifth) of the air in the phial, by the abstraction of oxygen, which unites with the phosphorus. This fact is instructive. It demonstrates to us, in a striking manner, that a vessel which may be impervious to a liquid may permit the entrance or exit of a gas or vapor; and it accounts for the decomposition of spirits, conserves, extracts, etc., that are put up in vessels that are supposed to be hermetically sealed, simply because they do not permit of the escape of their liquid contents.

Louisville, Ky.

Progress of Flying Machinery.

A new steering balloon by Smitter is being exhibited, suspended in the middle of the Alcazar in Paris. The measurement is only 6,000 cubic feet, but the balloon is so light that, when filled with pure hydrogen, it must float. A considerable sum of money has been invested in it, and great ability has been displayed in the construction. Although no practicable result in open air may be hoped for, it is a wonderful piece of clockwork. In connection with this subject, it is stated that, for several months past, a firm of engineers have been experimenting privately at the Crystal Palace with an aerial steamer of a novel and promising character, weighing 160 lbs. Experiments are stated to have proved the capability of two vertical screws, each 12 feet diameter, to raise a weight of 120 lbs.; the steam engine, with water and fuel, forming part of the weight so raised to the extent of 80 lbs. The power exerted by it is equal to two and a half horses. The communication of motion is given by a vertical axis emanating from the car.—*Nature.*

Recent American and Foreign Patents.

Improved Dumping Car.

Benjamin Slusser, Sidney, Ohio.—This invention makes a considerable change in the frame of a dumping car or wagon, so that the contents may be discharged with little expenditure of manual force, and yet with great facility, the tail board being made to open automatically.

Improved Fifth Wheel.

Jacob Hodge, Springfield, Ill.—The fifth wheel is a circular iron disk, the face of which is slightly convexed, and which has lugs formed upon its sides to receive the clips, by which it is firmly secured to the axle. In the center of the disk is formed a hole to receive the hub on the circular disk of the head block. The lower side of the head block has a circular recess to fit upon the fifth wheel, the face of which is slightly convex, so as to bring the bearing toward the center. Upon the head block is a transverse rib, upon which rests a spring. Upon the rear side of the head block are formed two flanges, and an arm or projection, having slight flanges formed upon its side edges to form a seat for the reach, the forward end of which abuts against the rib of said head block. The connection between the reach, head block, fifth wheel, and axle is strengthened by two metal straps.

Improved Gas Generator.

James C. Mitchell, Lancaster, N. H.—This invention relates to certain improvements in the manufacture of illuminating gas, designed to utilize any kind of fuel for the production of the gas, and applicable to limited manufacture, as for private families, etc. It consists in a retort placed within a furnace, or a common stove if desired, and having an airtight door of peculiar construction, and a communication direct with the furnace, by means of which construction the gaseous contents of the retort may be drawn into the furnace and burned, when the airtight door is to be opened for drawing and recharging the retort. It also consists in the combination with the feed pipe to the gas holder of a ball valve to prevent back pressure.

Improved Cotton Chopper.

Wm. D. Evans, Society Hill, S. C.—The invention consists in a rotary chopper having intervaled sets of knives on two drums arranged on a single shaft, so as to chop out two rows simultaneously.

Improved Egg Tester.

Wm. W. Wilson, Parkville, Mo.—The invention consists in an egg tester consisting of a case in whose center is placed a lamp, and in whose side is a horizontal tube having an egg-holding cap at the outer end.

Improved Gang Plow.

A. Schrader, Walla Walla City, Wash. Ter.—The invention relates to that class of gang plows whose frames are supported on swiveled castor wheels so as to regulate the depth of furrow, and consists in an improvement by which the front and rear wheels are simultaneously graduated by the driver, so as to determine the exact depth of furrow required.

Improved Post Hole Borer.

Obadiah Love, Saxenburg, Pa.—The object of the invention is to expedite and diminish the cost of post-hole digging by making the blades form a cage, tapering in an upward direction, and causing the soil to crumble and discharge itself.

Improved Automatic Car Coupler.

F. W. Nash and S. S. Kirk, Washington, D. C.—This coupler is adjustable to any car, and couples with any other coupler, by simply bringing the cars in contact. It can be uncoupled from side, top, or platform of car, avoiding the necessity of the attendant ever going between cars. It is claimed to combine simplicity, utility, durability, strength, and cheapness. For further particulars, apply to S. S. Kirk, Washington, D. C.

Improved Vehicle Tongue Support.

George W. Burnside, Prairieburg, Iowa.—By suitable construction, when the draft is applied, the downward pressure of a chain upon a pulley raises the tongue, and supports it, so as to relieve the horses' necks from its weight, and hold it raised so long as the draft strain is continued.

Improved Foot Treadle.

Daniel E. Lillis, Lockport, N. Y.—The invention relates to the construction of swinging foot treadles for sewing machines and others, in which an adjustable foot plate is bolted on to the hanging bar, for shifting forward and backward on the bar to balance the feet relatively to the pivot. Ribs are cast on the edges of the foot plate, in combination with the notched hangers, to assist the binding screw in holding the foot plate fast.

Improved Lamp Fount.

Edward Brown, New York city.—The lamp fount is provided with a thin circular outwardly and downwardly projecting flange around an inner conical cavity, a space being left between the flange and body of the fount to receive the fastening screw of a bracket.

Improved Bessemer Converter.

Almon S. Dunning, Joliet, Ill.—The invention consists of a converter, the nose of which is constructed at the front part in straight or flattened shape. By the removal of the projecting angle or curved convexity, the sectional area of outlet is greatly increased, and consequently the force and velocity of the blast diminished. Thus any metal rolling up will fall back. The invention states that he has made about twenty thousand tuns of steel under this improvement, and with not one fourth the usual overflow.

Improved Harrow.

Joseph Rioth, Mount Sterling, Ill.—The harrow frame is made in two parts. Each part consists of three or more parallel bars, connected. The two parts may be adjusted closer together or farther apart, as may be desired. The outer ends of the outer bars of each part have rings secured to them. To the draft bar are attached five staples. Two draft chains, the forward ends of which are hooked into two of the staples, are equally distant from the center of the draft bar. The chains are passed through forward rings, and are hooked into rear rings, or are turned back upon themselves and hooked into their own links. The draft may be applied to the other side of the harrow. By detaching the chains, the parts of the harrow may be folded together, so that it may be drawn upon its side in passing to and from the field.

Improved Blind Stop.

Charles E. Steller, Milwaukee, Wis.—This consists of a plate of metal, arranged between the inner edge of one of the stiles of the blind and the end of one or more slats, so as to oscillate a little. It has a cam button on the style, so combined with it that, by turning the button against the plate, the latter will be pressed against the slats, so as to hold them by friction in any position in which they may be set. It was fully described and illustrated on page 70, current volume of this journal.

Improved Combined Grave, Coffin, and Monument.

Leland M. Speers and Abraham Clark, Newberry, S. C.—This device is so constructed as to prevent the escape of odors and the entrance of water, while allowing the features of the dead to be viewed whenever desired. The invention consists in a combined grave, coffin, and monument, formed of the recessed lower part, the grooved cover made thicker at its head end, and having an opening formed through it, in which is cemented a glass plate and the cover for said opening.