Digging Wells.

The Massachusetts *Ploughman* some time since had the following directions in regard to digging wells:

The old way of digging a well and stoning it up so as to leave it about 3 feet in diameter, is a very good one if the water is to be drawn up with buckets; but if only with a pump, it is a very poor way; for if, as is the usual custom, the well be covered at the top, it leaves a very large space for dead air, which often becomes so bad that it affects the quality of the water, and also makes it unsafe to enter the well. When a well thus stoned has only a pump in it, the covering should be under water, or very near it; but if it is known that only a pump is to be used, the expense of stoning may be saved, and the water kept in a much better condition. This is done by digging the well in a dry time, and when dug as low as possible a cement pipe, some 2 feet in diameter and 2 or 3 feet long, is sunk at the bottom, and worked down as low as possible by digging out the inside. The pipe should be covered over with a flat stone, through the middle of which a two-inch hole has been drilled; directly over this hole stand up drain pipe, then begin to fill in the hole. When filled as high as the top of the first piece of drain pipe, put on another, being careful to have it straight with the other and the line perpendicular; continue filling and adding drain pipe until it is as high as the surrounding ground; or if the pump is not to stand directly over the well, then when it is filled within 4 feet of the surface put in the pump pipe and lead it off in a trench to where the pump is to stand. When it is found that the pipe is all right, finish filling the well, leaving some durable mark that the position of the well may be known.

A well of this kind is reliable and permanent, requiring no repairs; the water is cool and free from impurities that open wells are subject to; no insects or animals can find their way into it, and the cost is not more than one-half that of a well that is stoned. If dug, as it should be, when the springs are low, a constant supply of water that is as pure as the underground springs is secured. As the well is always full, there is no chance for bad air to injure the water, and, in fact, but little danger of being polluted by surrounding cesspools compared to that of open wells.

The Victims of Car Coupling.

Notwithstanding the great number of automatic couplers invented, probably most railroad men to-day are not convinced that there is one that meets the requirements. Even if they were, they would hesitate to adopt one which might not couple with the cars of their connections. Thus to the necessity of finding an efficient apparatus by which cars may be coupled without going between them there is added the further necessity of uniform and simultaneous action by the railroad companies concerning a matter not well understood, and regarding which opinions at present are likely to be very diverse.

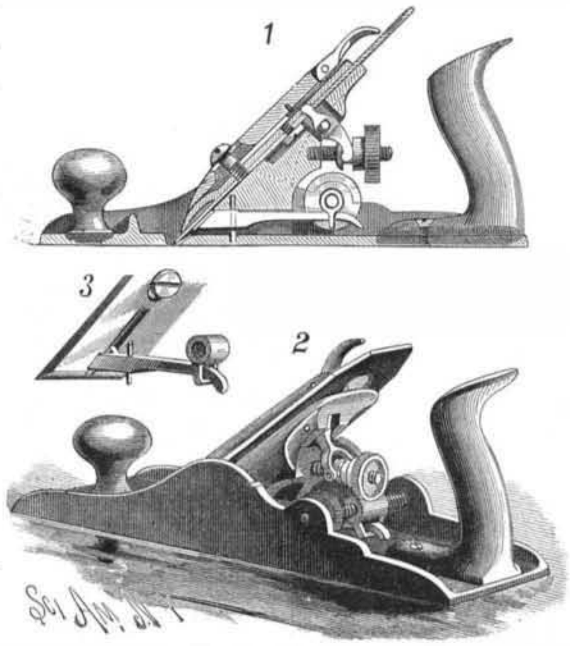
But the crushing and mangling of men by the thousands calls for some effort, at least, to prevent it, even if the way is not quite clear and action will be difficult. It justifies extraordinary methods, efforts, and expenditures. If it is true, as it probably is, that the railroad companies do not generally know of apparatus that will prevent the coupling slaughters, they should lose no time in finding out, in testing whatever has any promise with such thoroughness and completeness that they will all thereafter know what can and what cannot be done by the appliances offered for their use.

If they had had to pay for the killed and maimed brakemen, as they do for killed and maimed passengers, they would have been terribly exercised about the matter long ago; for the stockholder, not coming in contact with the victims, feels such things only in his pocket; and the pressure of the stockholder to save money *plus* the humanity of the operating officer is certainly more effective than the humanity alone. But even a modification of the employers' liability law, which would give the employe substantially the same rights as the passenger, might not greatly help in this matter; for, as we have said, the sufferers in car coupling are largely guilty of "contributory negligence," which would exonerate the company, even if a passenger were a victim. This kind of contributory negligence, though a good reason why the victim should not receive damages, is not always a good reason why the employer should not pay them.

This matter should not be allowed to rest, but its agitation by the inventors of car couplers alone is hardly likely to be fruitful. The railroad men should take it up, and they should need no other incitement than the regiments of men their cars have crippled and the companies of them they have killed.—*Railroad Gazette.*

BENCH PLANE.

Fig. 1 is a vertical longitudinal section, Fig. 2 is a perspective view, and Fig. 3 shows the arrangement for securing the lateral movement of the plane iron of a bench plane for which letters patent were recently issued to Mr. N. E. Curtis, of Mauston, Wis. In the upper surface of the bed piece is a groove to receive the screws which clamp the plane and cap iron together. This groove is long enough to permit the greatest required range of longitudinal movement of the plane iron, while it holds the sides of the screw head so closely as to admit of little or no lateral motion of the iron at that point. Fulcrumed in the bed piece is a lever, the short arm of which enters a hole in the cap iron; the long



CURTIS' BENCH PLANE.

arm is engaged by a milled nut on a screw threaded stud projecting from the back of the bed piece. By turning the nut the plane iron is adjusted longitudinally in the usual way. The plane iron and cap iron are held in place by a clamping lever similar to others in use; but the distance between the screw and the lower end has been shortened, and the distance between the screw and cam lever pivoted in the upper end has been increased, thereby securing greater leverage and increasing the firmness with which the plane iron is held in place.

A lever is fulcrumed in a mortise in the lower portion of the bed piece, so as to swing in a plane parallel with the face of the plane body. One arm of the lever is beveled and provided with a tongue entering a groove in the back of the plane iron. The long arm extends beyond the rear of the bed piece, and is moved by a traveling nut carried upon a screw journaled transversely in the plane body and having a milled head. By turning the screw in one direction or the other the lever is correspondingly moved, and the plane iron, by means of its engagement with the lever, is swung laterally, the clamping screw being the center of motion.

This construction enables the user to readily and accurately adjust the cutting edge of the plane iron so that it will be parallel with the face of the plane, and also enables him to quickly place the cutting edge at any desired height.

ON the Pennsylvania Railway the average consumption of fuel for all passenger trains is 56 pounds per train mile.

A PHOTOGRAPHIC REVOLVER FOR AMATEURS.

The apparatus which we are about to describe, and which is manufactured by Mr. E. Enjalbert, is very ingenious, very well conceived, and will, we believe, meet with great success. It is a true pocket revolver with barrel, stock, and cock, but instead of serving to throw deadly leaden balls it is designed for taking very small photographic negatives four centimeters square. Upon pulling the trigger the sensitized plates succeed one another, and the operator can thus suddenly take ten successive photographs without touching his weapon. These small photographs may be afterward enlarged, and serve as useful documents for tourists, amateurs, and artists.

With this little revolver there is no longer any focusing to be done, no more plates to be changed, and instantaneous views are obtained by an exposure of one-fiftieth of a second. The apparatus is always hermetically closed to the light, and it permits of following objects in motion with great facility, and without its being necessary to take accurate aim as with an ordinary revolver, since it is merely a question of taking such a general view as is comprised within the field of the objective.

The apparatus consists of five principal parts, which are shown in detail in the annexed figure.

1. *The Barrel.*—In this is adjusted the rapid, rectilinear objective, which consists of two achromatic menisci that are symmetrically arranged to give a focal distance of 0·042 mm. The revolver may be used from a distance of 4 5 meters, since, owing to the combination of the lenses' curves, the different planes are then all in focus. The ever tedious operation of focusing is thus avoided. The diaphragms accompanying the apparatus are placed in the very interior of the objective, between the two lenses.

2. *The Camera.*—This consists of a cylinder, H, that contains a shutter, A, and a frame holder, C. It is into the front end of this chamber that the barrel is screwed. The shutter, A, is capable of revolving freely upon its axis. It contains an aperture, B, equal to a quarter of its surface, and carries a small clockwork movement that gears with the pinion of the axis of the camera. This clockwork movement, when its spring expands during its revolution, necessarily carries along the shutter. The spring is wound up by revolving the cylinder, G, when it is in place. At this moment, in fact, it catches and holds the end of the axle, which enters a square aperture in its center. Upon pulling the trigger the two teeth seen at K are thrust forward. The first of these, which, when at rest, stops the shutter, now frees it and allows it to make one revolution that opens and instantaneously closes the apparatus. The shutter, on reaching the lower end of its travel, abuts against the second tooth. The shuttle-motion that occurs in the rear when the trigger is freed disengages this second tooth, and allows the first to engage with the starting notch again, so that the shutter is then ready to operate anew if the spring is sufficiently taut.

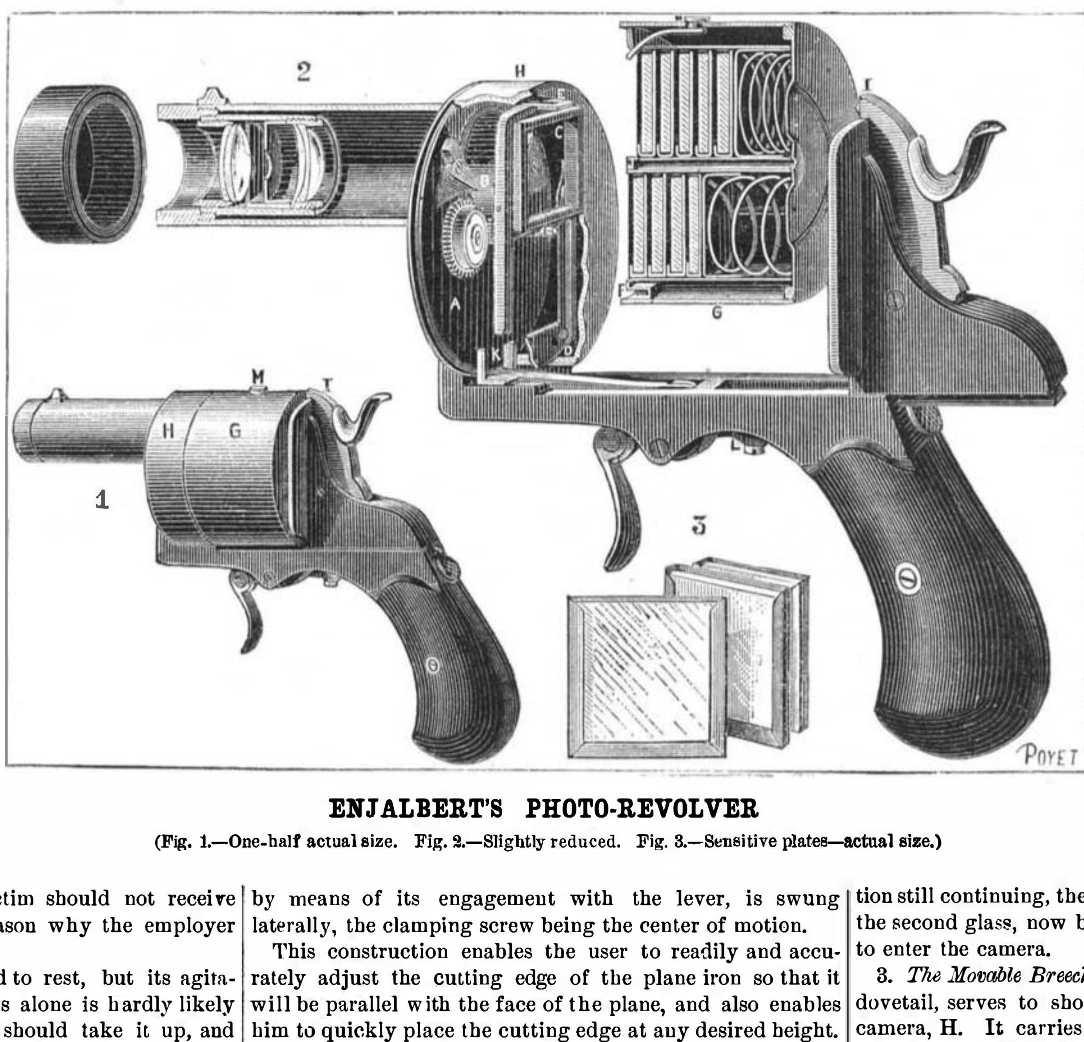
The frame holder, C, is hinged beneath, at D, and terminates above in a bent tooth, E, which causes it to advance or recoil a distance equal to the thickness of one of the frames, according as it has in front of it the upper or lower case. This motion is obtained by means of the rabbet, F, at the bottom of the cylinder.

3. *The Plate Cylinder.*—This is divided into two rectangular compartments in which slide two plates that are thrust forward by spiral springs. The upper case contains the sensitized plates held in their frames (shown of actual size in Fig. 3), while the lower one collects them in measure as they have been exposed.

The cylinder, G, revolves through the friction of its edges against the chamber, H.

When the upper case is opposite the aperture, C, the tooth, E, forces back the frame holder, the first frame enters the open space in front of it, and the glass is thus in place for the operation. In order to remove this glass and substitute the succeeding one for it, the cylinder is made to perform one entire revolution. The first glass remains in the aperture, C, in the camera, when the cylinder begins to revolve. Then, the revolution continuing, when the second compartment comes opposite this glass the tooth, E, enters the rabbet, F, and the glass naturally enters the said compartment. The revolution still continuing, the cylinder takes its position again, and the second glass, now become the first, is, in its turn, made to enter the camera.

3. *The Movable Breech*, which is fixed upon the stock by a dovetail, serves to shove the cylinder, G, up against the camera, H. It carries a spring cock, whose extremity, I, enters a recess in the back of the cylinder and prevents the latter from revolving, and also indicates the position of the cases when they are well opposite the objective.



ENJALBERT'S PHOTO-REVOLVER

(Fig. 1.—One-half actual size. Fig. 2.—Slightly reduced. Fig. 3.—Sensitive plates—actual size.)

5. *The Stock* connects the different parts of the apparatus with each other. The trigger actuates a lever that passes under the cylinder, G, and that terminates, as before stated, in two teeth, K. The small turn button, L, beneath the trigger serves as a catch.

The manipulation of the apparatus is simple, and may be sufficiently understood from the foregoing description without further dwelling upon it.

This photo revolver offers but one drawback, and that is that in certain cases it may frighten those at whom it is directed. But it is easy to remedy this by covering it with a handkerchief so as to hide its terrifying aspect.—*La Nature.*

AMERICAN INDUSTRIES.—No. 89.

[SEE FIRST PAGE.]

THE MANUFACTURE OF PAINTS, VARNISHES, BRUSHES, AND ARTISTS' MATERIALS.

Only those directly connected with the business can fully realize how enormous has been the increase of American production in this line during the present generation. The growth has been far more than proportionate to the increase of the population, for two reasons—first, the manufacture here has been so improved that we now import very little except raw materials; and second, the condition of the great body of the people has been steadily improving, so that we have more comfortably and tastily fitted up homes, workshops, and business houses, to say nothing of the great demands which modern railway and steamboat traffic have given rise to. And all these causes contribute to making the business in paints and varnishes of much more importance, proportionately, in our industries, than it was a generation ago.

In our first page illustrations we give representations of some of the most important details of the manufacture, as conducted at the extensive paint works of Messrs. F. W. Devoe & Co., in New York city, and at their varnish factory in Newark, N. J. Their manufacture includes colors of all kinds, either dry, ground in oil or water, or in pulp, ready-mixed paints, colors in japan for coach and carriage and railway car painting, and fine varnishes and japans, with every variety of brushes, artists' materials generally, and mathematical and surveyors' instruments.

Although in many pigments the manufacture has been greatly changed within a recent period—more especially since the introduction of the aniline colors—the making of dry white lead and of zinc white, which constitute a large portion of all the paint used, and form the basis of many of the colors, has remained substantially unchanged through a long period. Formerly white lead was largely imported, but there are now some forty corroding establishments in the United States, and imported white lead is almost unknown. In zinc white, however, we still import our best qualities, Messrs. Devoe & Co. using the Vieille Montagne product, made in the largest establishments of the kind in the world, at Paris and Liege. This is a purer article than that made here, from the fact that the American zinc white is made direct from the ore, while that which they import is made from the metal, and, although the house makes all grades of colors which have a popular demand, they sell none carrying the label of their own name and trademark which is not strictly what it is stated to be. White lead and zinc white are much adulterated, for the cheaper paints, with chalk, barytes, and other adulterants.

In making and preparing for use the various pigments which go to make up the great variety of colored paints, an extended knowledge of chemistry is indispensable. Chemically manufactured colors, such as chrome yellow and green, Prussian blue, and vermilion, are not durable when in exposed conditions, but either of these may be mixed with vehicles which will add greatly to their permanence. Ultramarine blue, as now made—for that made from lapis lazuli has been entirely superseded by the cheaper artificial blue—is a durable color, but care is required in mixing it with white lead to be sure that the lead is pure, for that adulterated with barytes is very injurious, causing the blue to fade quickly. Carmine, also, if mixed with varnish instead of oil, is a durable color, although much of the durability of any color is largely dependent upon the ground on which it is spread and the exposure it receives, as well as the vehicles used in mixing. There has long been a good deal of difference of opinion among painters as to the use of white lead and zinc—some strongly advocating one and some another—but these differences are now resolving themselves into pretty general unanimity of opinion that zinc white has many advantages for interior work, and that for exposed situations the most durable white is a mixture of white lead and zinc white in nearly equal parts. But however the painters or the public may differ in opinion on this point, the doctors all strenuously oppose the use of white lead as eminently injurious to those who make it and the painters who use it.

In the manufacture of all their goods the firm start with the raw material, and carry it forward through all the successive stages. Mr. Isaac Wyman Drummond, E.M., Ph.D., has direct charge of the chemical examinations and experiments necessary, and the importance of the most careful attention in this department for the making of durable colors cannot be overestimated. The permanence of colors in secondary or mixed paints depends primarily on the chemical relations of the colors and pigments employed. These secondary colors are produced by various combinations, and the rule is to use the least number of colors possible to secure the desired tint. It is thus that, with the best of skill in the chemical manipulations, and experts to attend to the mixing and all the details of the manufacture, a variety of colors and an excellence in quality is attained which it would be impossible for any single workman to hope to reach.

In our illustrations are given thirteen views of as many different departments of the business, besides one showing the interior of the large and handsome store at the corner of Fulton and William Streets, New York.

In the left hand corner at the top of the page is shown the mixing and grinding of the pigments for standard colors, while adjoining it in the center is a view of the process of making the finer artists' colors furnished in tubes. The engravings are necessarily small, from the desire of the artist to bring into the group as many departments as possible. There is nothing, perhaps, that would be entirely new to the well informed mechanic in the manner of mixing and grinding the colors, but the advantages possessed by a large establishment for doing this work, with ample power and the most perfect mills, make it an easy matter to secure great fineness and uniformity in the product. The constituents required for the different colors and shades are accurately weighed and measured out before they are put into the mills, and the work is afterward done with mechanical precision. The grinding of the artists' tube colors is done on a circular glass table on which, in a regularly changing ellipsis, revolves a heavy granite block.

On sanitary grounds alone, the extent to which ready ground and mixed paints have come into use within the last few years is a matter of public good fortune. The grinding and mixing of paints were among the most unhealthful parts of the business, when done in the old way, as the dry powder was to some extent absorbed by the skin or taken in by breathing, while its being directly taken in through a scratch in the skin was not uncommon, and all tended to give a high death rate among painters before the attainment of middle life.

The pulverizing of dry colors, shown at the left, about the middle of the page, is done with powerful mills, the pigments, when large enough to require it, being first passed through a breaker and then ground between heavy stones, and bolted to secure uniform fineness, much in the same way that flour is ground.

The white lead and zinc grinding, shown immediately below, forms a most important part of the business. The lead or zinc, with its requisite quantity of oil, is placed in a mixer, which has a trough or gutter in a circle, on a bed about six feet in diameter, in which rolls around a stone also about six feet in diameter, and eight inches face, until the oil has been thoroughly incorporated to make a paste or pulp. Thence this is drawn by pipes into mills on the floor below, where it passes between powerful grinding stones, and comes out slowly in a thick paste of great fineness and entire uniformity.

In the grinding of colors for house painting, or what should be more properly styled the making of the ready mixed paints for use without change, the firm do an extensive business. A large portion of their goods are simply ground in oil to a paste consistency, leaving the painter to thin and put in such drier as deemed best; but in those goods sold in cans, pails, etc., ready for use, the requisite driers and all necessary ingredients are incorporated, and the buyer only has to select the color or shade required from the sample on the label or specimen sheet.

The making of vermilion, shown in one of the views, requires a large department. This is principally made from carbonate of lead and bichromate of potash, with water, the resulting liquid being left to settle in large tanks, the sediment being laid out in batches to dry, the final moisture being absorbed by chalk blocks on which the rough cakes are placed. This vermilion has been in practical use for several years; it does not turn brown or blacken, but retains its brilliancy under exposure to sun or weather.

In all the varieties of umber and sienna made, of which the manufacture includes everything known to the trade, the raw umber and sienna are imported by the hundred tons, and burnt, ground, and passed through all the requisite processes on the premises, as is also the case with the various grades of Vandyke brown. For their ivory black the firm buy ivory chips from the manufacturers of billiard balls and ivory goods, and burn it themselves, to be entirely sure of having a perfectly pure article, which they sell in the powder or in the form of drop black.

As a substitute for the chrome or Paris green, the firm have for several years been making a very popular shade of green, known as the "Park Lawn Green," which is much used for window blinds, agricultural implements, ornamental iron work, and machinery, and they also make another shade, known as "Clover Leaf Green," which is strong and brilliant, and with great covering properties.

Of coach and car colors, ground in japan, the firm make a specialty, and furnish all the supplies required by several prominent railway lines. It is absolutely necessary that the identical shade adopted shall be preserved in all subsequent orders, and that the materials shall be the same, so that the wear will be uniform, and on this account they usually make up large lots at one time, so as always to have a supply on hand. For these colors the firm received a gold medal at the National Exposition of Railway Appliances in Chicago last year.

Not the least among the departments of the business is the large tinshop, where the pails, cans, and painters' tinware are made. Everything of that kind required is made on the premises, the most improved machinery being employed, and every piece being made by a pattern that cannot fail to secure absolute uniformity.

The brush making department of the business covers the manufacture of every kind and grade of brushes known to the trade, from the fine sable to those made of bristle—brushes for the japanner or varnisher, the painter, or the artist—and for all classes of work. The deftness with which the hands put together this work, the facility with which they even up the tufts of almost silky fineness, or separate bristles which have split points, or which have been laid with the roots where the points should be, is something quite wonderful to one who has never seen the work in progress. Everything in this room is made according to sample, and specimens to work by are hung up near every work table.

The making of artists' canvas boards requires a large department. Only the best English linen is used, made especially for the purpose; this is first stretched tightly on the frames, and workmen go over each inch of the surface to remove all pin heads or imperfections of the flax—then come successive coats of specially prepared lead and filling, to make a smooth, firm surface, such as best adapted to make an even and permanent surface for the artist's work.

The manufacture of surveying and mathematical instruments, to be used in railroad construction and for engineers, architects, and draughtsmen, as well as for technical schools, has naturally grown out of the gradual expansion of the business into the filling of all the wants of artists, and everything required by contractors who use their paints. A view of this department has been necessarily omitted from our illustrations, but here are made squares, triangles, compasses, pantographs, and a large variety of other instruments, while the transits, theodolites, and levels furnished by the firm have been approved by and are in the use of the United States Coast Survey.

For the making of varnish and japan the works are at Newark, N. J., and representations of some of the leading details in this branch of the business are shown in the views on the right of the page. The first operation in order is the chipping, which is in reality little more than the removal of the outside crust or coating, and the separation of any impurities. There are in all some thirty different resins or gums of which varnish is made, included in which are principally amber, copal, gum cowrie, animé, and common resin. There are natural lacquers from India and China, and drying oils which resinify by oxidation in the air, but oil varnishes proper are composed of an intimate combination of a drying oil with a fused resin, which hardens by the oxidation of the air. Besides these there are varnishes which have a volatile liquid holding in solution resins or gums which, on the evaporation of the solvent, leave behind a vitreous coating on the surface varnished.

The oil used is principally linseed, which from its high drying property and its general constancy in quality is the great favorite in nearly all varnishes. It is obtained as new, sweet, and free from rancidity as possible, and then clarified and allowed to settle for weeks, after which it is drawn off for use. By boiling, the fatty constituents of the oil—glycerine, palmitine, etc.—are volatilized. The various methods of mixing the oils and gums or resins, and the manner and extent to which they are heated together or separately, necessarily vary with the particular kind of varnish or japan being made. It is a branch of the business which calls for the greatest knowledge, experience, and care, together with a skill which can only be acquired by long practice and observation. The resin must be so prepared as to be readily soluble in oil, and then so incorporated as to form a compound which shall be perfectly soluble in turpentine, and so that, on the evaporation of the latter, a hard surface will form before dust, under ordinary circumstances, will attach to the varnished surface. The high success of the firm in this branch of their manufacture, through many years of steadily increasing business, affords the best criterion of the quality of their goods.

The works of the firm in New York city have a frontage of 200 feet on Horatio Street and 175 feet on Jane Street, with a floor space of about four acres. This part of the business is under the especial superintendence of Mr. James F. Drummond, a member of the firm who has attended entirely to the manufacturing since 1856. A view of the main salesroom, at the corner of Fulton and William Streets, forms one of our illustrations, the business department being under the direct personal supervision of the two other members of the firm, Messrs. Frederick W. Devoe and J. Seaver Page. The first floor above, of the full size of the store, is devoted to artists' supplies and painters' sundries, including an assortment of almost everything even remotely connected with painting and decorating. The firm have a branch house in Chicago under the style of Coffin, Devoe & Co.

A Suggestion about Color Blindness.

May not some people, who know well the difference between colors, yet fail to characterize by their proper names the colors recognized? This question is asked by a Kentucky correspondent, who suggests that some of the railroad employes discharged because of not being able to recognize a red, a white, or a green light, may still, as many of them undoubtedly are, be able to distinguish a light which means danger from one that does not. It is so simple, in such a matter, to learn to call things by their right names, where there is the capability of distinction, that we should be inclined to think the failure to do so indicated too low an intelligence for its possessor to be in any way intrusted with responsibility for human life.