SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyrighted, 1887, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

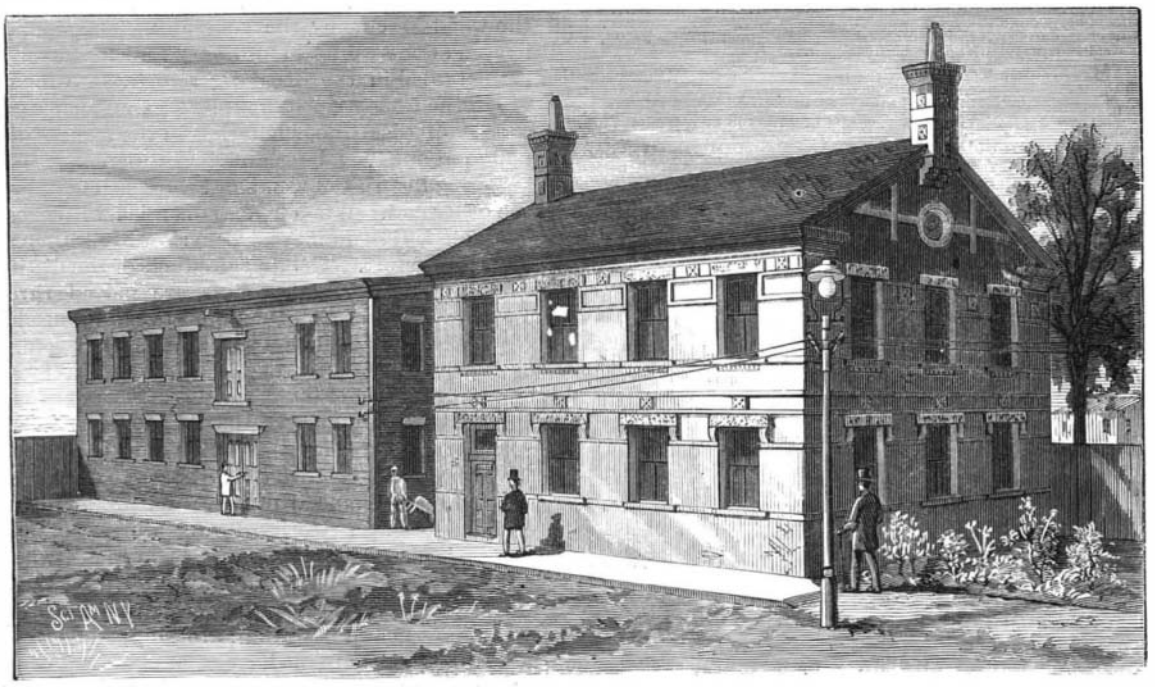
Vol. LVII.—No. 19. [NEW SERIES.] NEW YORK, NOVEMBER 5, 1887. [$3.00 per Year.

THE RESEARCH LABORATORY OF MR. EDWARD WESTON.

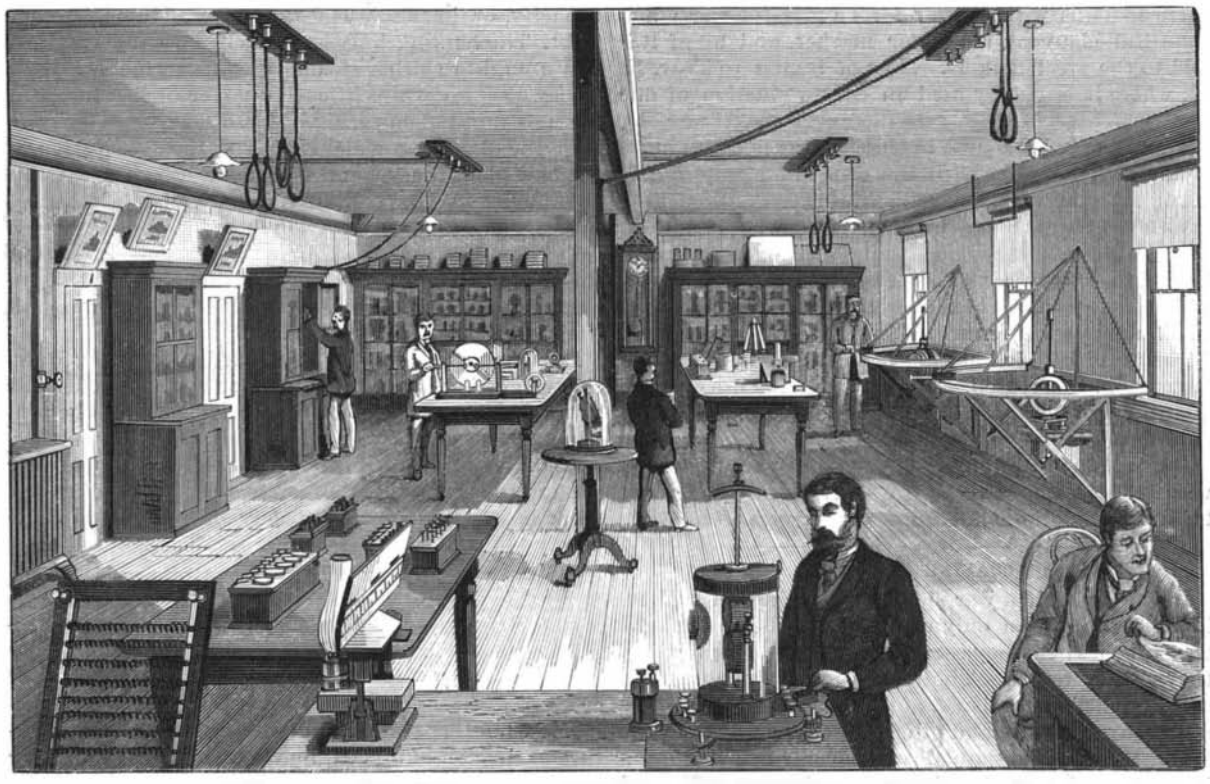
Among the pioneer names in electric lighting, as regards its development during the last ten years, none occupies a more prominent position than that of Edward Weston. With Maxim, Edison, and Brush, he stands as a representative of the American inventor. In this issue we present our readers with views of his private laboratory, recently completed.

Modern invention has now assumed a phase where the finest and most correct workmanship is needed to carry out the inventor's ideas. The models that are only experimental, as well as those representing the completed invention, have to be constructed in the most perfect manner. Unless the ideas of the inventor are well carried out mechanically, delay and discouragement will attend every step. This is not all. To ascertain how much of good there is in the more scientific inventions, a series of tests have to be applied. These must be accurate to possess any value. In many instances also the quality and composition of the materials used have to be investigated.

The laboratory we illustrate is the embodiment of such ideas. It includes, for constructive purposes, a selection of the highest grade of tools and machinery, driven by steam power. For other work it provides electrical testing and experimental apparatus, and a chemical laboratory, with all the concomitants. In its four main rooms and in its offices and smaller apartments everything is contained that can aid the inventor in quickly bringing his ideas into concrete form and determining their value when so presented.



EXTERIOR OF MR. EDWARD WESTON'S RESEARCH LABORATORY, NEWARK, N. J.



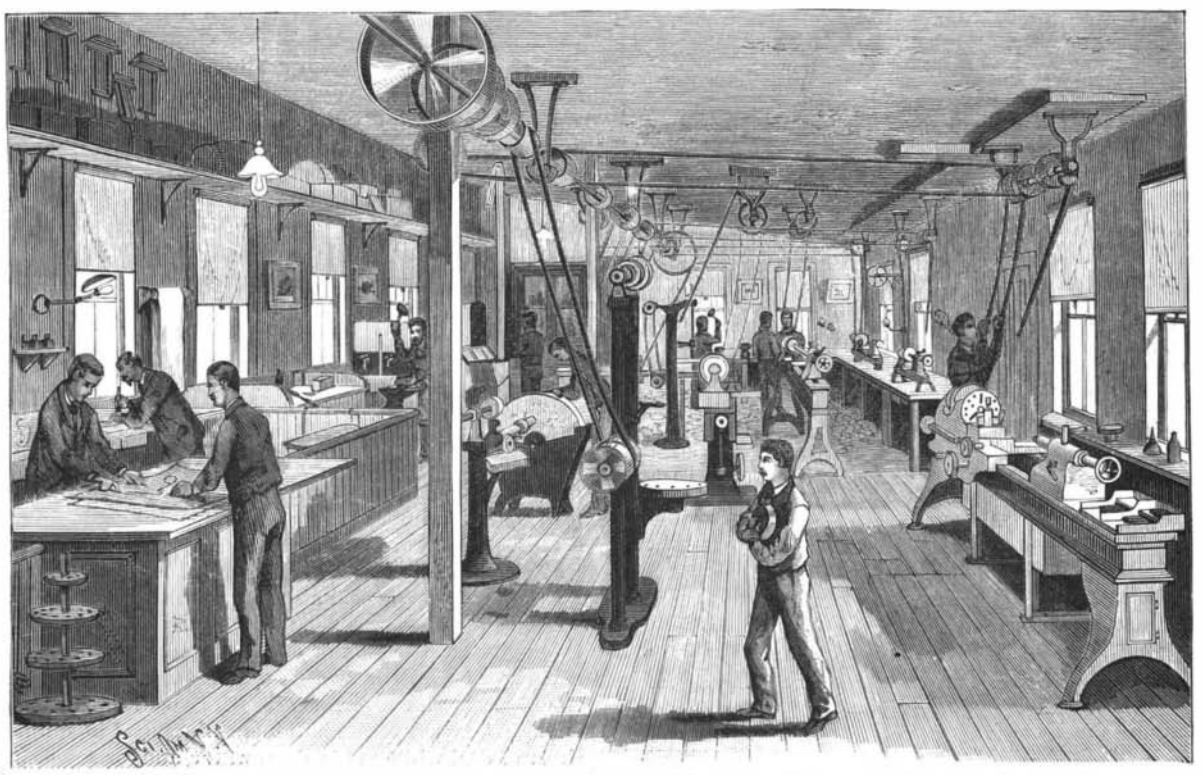
PHYSICAL LABORATORY AND DEPARTMENT OF GENERAL TESTING WORK.

The laboratory is situated in the rear of Mr. Weston's residence, in High Street, Newark. Two large buildings are devoted to the shops and laboratories proper. Between them is the boiler room. It contains an upright boiler, feed water heater, injector, and other appliances. The boiler and principal pipes are coated with non-conducting composition, and the little room is the acme of neatness and of approved arrangement. The boiler not only supplies steam for driving the machinery, but also that which is required for heating the rooms in winter.

On entering the buildings the experimental and office department is first reached. In this motors can be tested and the general running of machinery can be investigated. On one side are the offices of Mr. Weston and of his chief assistant. The main engine is situated here, immediately adjoining the boiler room, and is a model in its way. It is an Armington & Sims high speed engine, interesting as being a present from the builders. It is surrounded by a polished railing, and by belting and countershafts drives all the machinery. It is provided with indicator connections, so that its running can at any time be tested, and the indicated horse power determined. On this floor also is a photometer, on which incandescent lamps are tried to determine their illuminating power. In testing them they are photometered in various positions, in order to obtain an average result or "the spherical illuminating power." In this line Mr. Weston has made some interesting investigations, and has determined a few critical positions which give a correct average for spherical intensity. Upon the photometer table is a sphere of wood, with the relative values of different projections of light from an incandescent lamp marked upon it. In this room also are a very perfect set of rolls for rolling metal, and various other apparatus.

Ascending a flight of stairs, the machine shop is reached. A full set of Brown & Sharpe machinery is here provided, including a universal grinder, lathes, shapers, milling machines, planers, and drills. Each piece is the best that could be constructed. No attempt is made to have large or heavy machinery, the work done not being on the manufacturing scale. In addition to the lathes and other machinery, a full set of gauges is supplied. Proof planes, straight edges, steel rules, inside and outside vernier calipers, and gauges for depth, and for screw cutting, both male and female, are kept here in cases. There is much of value to be derived from their examination, and more space than is at our command might be devoted to them. They represent a complete set of mechanical standards. A dial calibrating machine is of special interest. In it the contact between the object and the calibrating surfaces is brought about by spring pressure. This elimi-

(*Continued on p.* 290.)



MACHINE SHOP AND MECHANICAL DRAWING DEPARTMENT.

THE RESEARCH LABORATORY OF MR. EDWARD WESTON.

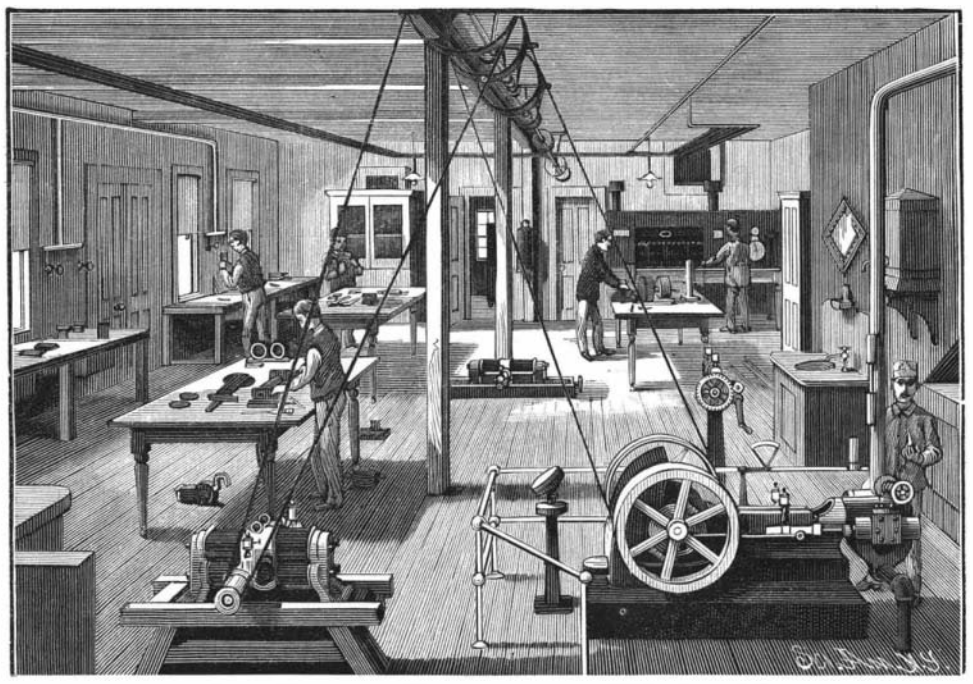
(*Continued from first page.*)

nates the personal element, so that yielding substances, such as hairs, vegetable filaments, and the like, can be accurately gauged. The readings are given directly on a dial, two inches or more in diameter.

Much of the work done in this department requires special cutting tools, and already quite an assortment of these has accumulated. They are all kept carefully in drawers. Among others, one tool for cutting out a hemispherical cavity in a copper block, used in the galvanometer, soon to be mentioned, is worthy of special notice. Its face is an accurate half circle in contour. One quarter of the circle has its edge beveled upward, the other quarter downward. It is used for cutting into the face of the block as the latter is held and rotated in the chuck. The mere construction of this tool of sufficient accuracy for the work it is called on to execute is somewhat of a mechanical triumph. Other tools of various profiles for the same galvanometer, and also for other apparatus are preserved, some of ogee-like profile, and all beautifully executed.

In one corner of the room, where the light is best, is a drawing table, where the drawings of apparatus are executed for record and for the machinists' use. For the past five years, one sheet of drawing per day has been averaged by Mr. Weston, and every sheet shows some new invention or improvement on prior devices.

The above is but a very incomplete account of all that this room contains. From the cut a very good idea of its general arrangement may be obtained.



PHOTOMETRIC AND EXPERIMENTAL DEPARTMENT.

Next to it is the balance room. This contains an analytical and assaying balances, as well as other scales for common weighing. The balances are of Becker's manufacture, and are sensitive to less than one-tenth milligramme, or about one one-hundredth grain.

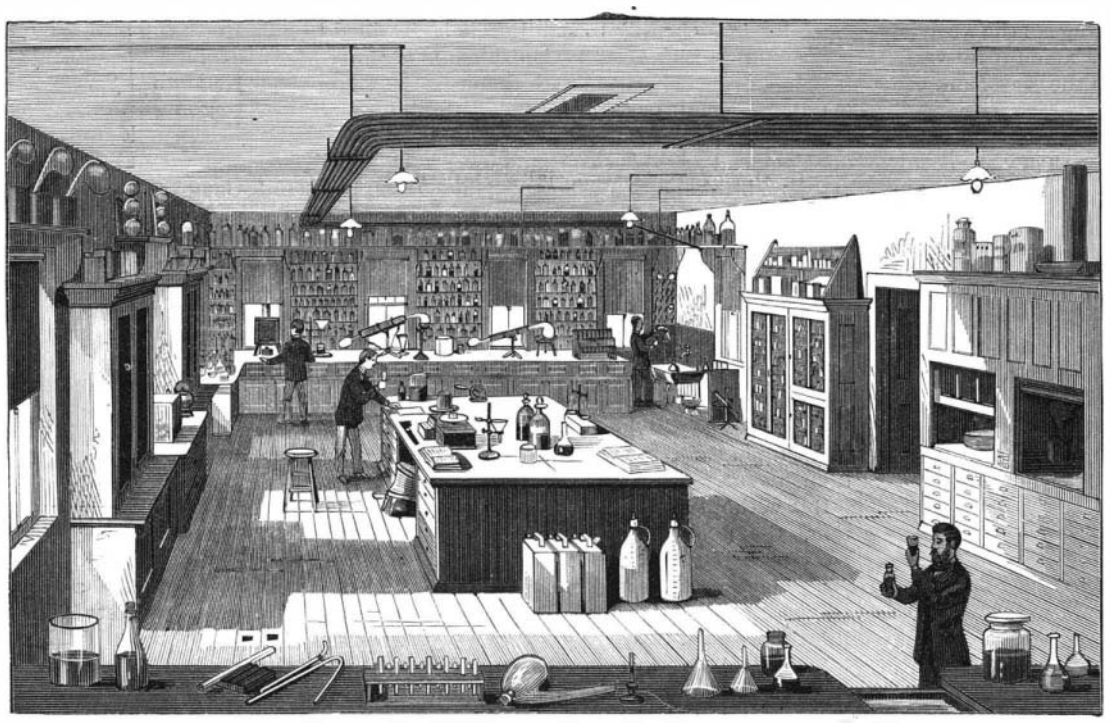
Passing through this room, the chemical laboratory is entered. In this room everything required for chemical work is kept. Supplies of beakers, test tubes, glass dishes, and crystallizing vessels, retorts, agate mortars, Berlin porcelain ware, and all kinds of chemical apparatus are stored away in the cases in profusion, or distributed and in use on the tables. The walls are lined with shelves for bottles, and a large supply and variety of chemicals are kept on hand. Closed chambers for the evaporation of acid or other solutions of corrosive or poisonous character are on one side of the room. In this room Mr. Weston has carried out the overhead system of heating. The coils are shown in the cut. They are carried around the room about three feet below the ceiling. The general action is to heat the air and cause it to rise against the ceiling. There the currents of air curve over and are forced downward, supplying warm air to the whole inclosed volume of the room. The system is found very perfect in practice. It operates without draughts, and is much more powerful than the ordinary radiator system. It resembles to a certain extent or is analogous to the plenum method of ventilation.

The working tables are to be supplied with gas, steam, electricity, hydrogen, air under pressure, and vacuum or exhaust, all by pipes or leads, and independently of each other. Each experimenter will have all these at his command.

The chemical department is not a mere adjunct of the rest. It is distinct in itself. Mr. Weston has done much independent work in chemistry, while the same science has been subsidiary to some of his most important work in electricity, notably in the production of the tamidine filament.

This substance is really the only unorganized filament ever used in an incandescent lamp. Gun cotton is dissolved in a mixture of ether and alcohol and evaporated so as to give a sheet of collodion. This is hard and horn-like in appearance, and quite devoid of any structure, being entirely amorphous. By the use of a reducing solution such as sulphide of ammonium, the nitrogen dioxide radical characteristic of the composition of gun cotton is destroyed, thus doing away with its highly inflammable or explosive character. From this sheet the filaments are cut, their width being regulated to one ten-thousandth of an inch. These are carbonized in the usual way, and form a filament resembling Russia sheet iron in luster and color

Under the chemical laboratory is the physical department. This naturally is largely devoted to electricity, and contains a large quantity of the most advanced forms of resistance coils by Elliott and other makers, and of galvanometers, reflecting and quadrant, and other apparatus, some of which were imported, and some were constructed by the proprietor. A very remarkable Sir William Thomson quadrant galvanometer is included, whose glass is quite tight, and does not "leak," a very unusual quality in this instrument, and almost impossible to attain. Against the wall are placed two reflecting galvanometers of Mr. Weston's invention, one a current and the other a potential galvanometer. They are on the tangent principle, and are of the highest degree of accuracy. Each is constructed for the reception of two coils, and by arranging these coils in series, in parallel, or in opposition, a very extended range is covered. The magnet is ring shaped and is suspended in a spherical cavity between two copper blocks, each containing one-half of the spherical cavity. The magnet carries a cross bar with sighting hole, which corresponds with a sighting hole through the inclosing copper block. By this it is adjusted for height and lateral position. The copper block acts as dampener, so as to make it almost completely dead beat. To obtain perfect contact between the two portions of the block, it is gold plated. The mirror is attached to a wire from which the magnet also hangs in prolongation of the suspending filament. Its deflections are read by a telescope, the scale for the deflections being marked upon the inner surface of the large semicircle inclosing it, which is shown in the cut.



LABORATORY FOR ORIGINAL AND CHEMICAL INVESTIGATION.

For experiments in electricity, four leads of wire hang from the ceiling, so that the work of the investigator is made easy by the accessibility of the connections. The physical department is also very fully provided with apparatus for lectures, demonstrations, and general work. Spectroscopes, a large collection of photographic apparatus, magic lanterns, polariscopes, and other physical appliances provide for illustration, for research, and for experimental work of the widest range. Two superb microscopes are ready for micro-chemical and other work.

For so complete a laboratory, a very perfect system of records is required. This is carried out on the card catalogue system, all work being fully recorded, indexed, and the description and calculations being filed away. A definite form of record book is provided for use in the laboratory, and an exact system is made to contribute to the work and records.

Mr. Weston's extensive library is not the least important element. Starting with ancient books on magnetism, it is brought down to the present day, and is constantly added to. It includes several thousand modern works and many others historically of the highest interest and now difficult or impossible to obtain.

Two of the most curious are the old works in the Latin language, *De Viribus Electricitatis*, by Aloysius Galvani, Modena, 1792, and *De Magnete Magneticisque Corporibus et de Magna Magnete Tellure*, London, 1600, by William Gilbert. These are respectively the earliest books published on electricity and magnetism.

The Preserving of Plums.

It may be worth while at this time of year to call attention to a simple and easy way of keeping damsons from season to season.

Into a clean and dry forty ounce stoppered wide mouthed bottle pour half a drachm of chloroform, then pack in a pound and a half of the sound fruit, and introduce the stopper, slightly vaselined. It is desirable to tie in the stopper with twine, as it is sometimes blown out during warm weather. For a week or two the fruit retains its natural appearance, then drops begin to exude from the surface, which gradually collect into a perfectly clear, richly colored liquid, partially filling the bottle. The fruit at the same time shrinks a little. In this condition it may be preserved without further change for at least a year, and probably for much longer periods. When eaten raw, the damsons have a slight, but by no means disagreeable, flavor of chloroform, and would be a pleasant addition to the dessert table, to be partaken of sparingly, like brandied cherries. On cooking, the chloroform entirely disappears, and the flavor is that of the fresh fruit. The quantities given above are those which have yielded a successful result, and I do not think that a less proportion of chloroform would suffice to keep the fruit. The quantity in each vessel might of course be determined by convenience, and is only limited by the difficulty of getting large bottles with perfectly fitting stoppers.

The experiment was of course suggested by the well known inhibitive action of chloroform on the functions of microbes, and several other plans were tried, such as the use of chloroform water in which to keep the plums, and of corked vessels, vaselined over, where the chloroform alone was used. Success, however, was only met with under the above given conditions, though no doubt others might be devised which would have the requisite effect of keeping in the chloroform vapor, and thus paralyzing the yeast cells and septic organisms. Probably other fruits and provisions might be preserved in the same way, though in the case of animal food the solvent action of the chloroform upon fats might interfere. The great advantage of chloroform over salicylic acid and other fixed antiseptics is that it is got rid of in the act of cooking—*Thomas P. Blunt, Pharmaceut. Jour.*

LIQUID stove blacking: Pulverized black lead 1 pound, turpentine 1 gill, water 1 gill, sugar 1 ounce.