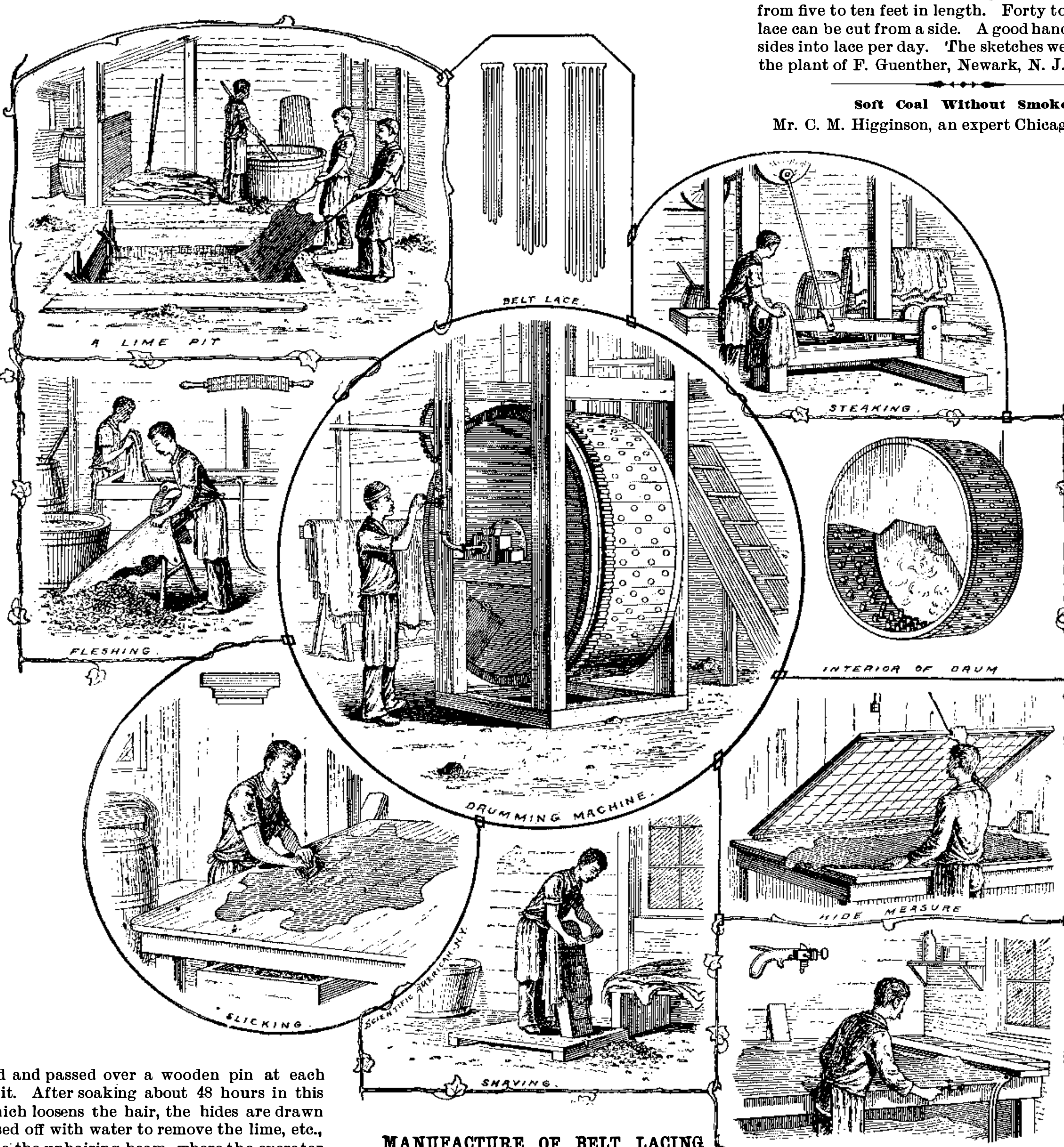
MANUFACTURE OF BELT LACING.

Belt lace is used principally in manufactories for sewing machine belting. It is manufactured principally from the hides of cows and steers, the process which they pass through causing them to become soft, tough and pliable. As soon as the hides are removed from the carcasses of the steers they are salted and carted to the tanners or lace makers. They are then placed in water overnight and then brushed with a knife, the soaking and brushing process causing the removal of the salt, blood, and fat or grease. From the soaking tubs the hides pass into the lime pits, which are about 7 feet in depth and about 5 feet square, and are made of either wood or stone. These pits contain a solution composed of 1,000 gallons of water, about ½ bushel of lime, and about 10 pounds of sulphite of sodium. A pack of about 40 hides is lowered down into this solution by means of a piece of rope fastened to each hind shank, the end of the rope being looped and passed over a wooden pin at each end of the pit. After soaking about 48 hours in this solution, which loosens the hair, the hides are drawn out and rinsed off with water to remove the lime, etc., and taken to the unhairing beam, where the operator scrapes off the hair with an instrument similar to a carpenter's drawknife. The hair from 50 to 60 hides can be scraped off daily by a good hand. After rinsing they are then fleshed. The under side of the skins or hides as they come from the slaughter houses have pieces of flesh adhering to them, which are removed by means of a knife on what is called a fleshing beam. These beams are oval shaped and made of hard wood. A hide is spread over this beam and the operator takes a sharp knife, cutting off the particles of flesh and also trimming the hide down to the veins, making it of an even thickness. A good hand can flesh about 60 hides per day.

The trimmings or particles of flesh are sold to glue manufacturers, bringing about 25 cents per bushel, the particles being kept from spoiling by means of a little lime added to them. The hides after fleshing are soaked for about two hours and then go through a tanning or drumming process. The drum in which the hides are tanned is circular in shape and made of cedar. It is 7 feet in height and 3½ feet in width, and perforated with about 200 1 and 1¼ inch holes, through which and projecting out on the inside are the same number of wooden pins 4 inches in height. The tanning solution, which is composed of water, with 72 pounds of alum, 24 pounds of salt, and half pint of neat's foot oil, is put into the drum with from 10 to 12 hides, the drum being and then set in motion. The interior is then heated up to a temperature of about 100° (F.) by means of a steam pipe passing through the shaft in the center of the drum. The revolving of the drum causes the hides as they are carried upward to fall down against the pins, which forces the tanning solution through them. After revolving about one hour at the rate of 10 revolutions per minute, they are taken out and hung on to wooden horses to drain for several hours, and then they go through a second drumming with a similar solution for about 40 minutes. They are then run through water and allowed to drain and dry overnight. The hide when dry is very stiff, and has to be dampened before it is steaked. This is done by drawing the hide through water. The steaking machine is about 7 feet long, and consists of four upright pieces of oak 2½ feet in height and about 8 inches in width, two of which are bolted opposite each other to one end of a heavy piece of planking, and the other two pieces to the other end.

The uprights are about 6 inches apart. Fastened to the top of two of the uprights is a blunt knife, over which the attendant holds the hide. The leather is softened by the downward stroke of a circular oak bar, which is connected by means of a circular iron rod to the machinery above, the other end of the bar being pivoted between the other two uprights. When the bar strikes the hide it forces it over the knives and down between the uprights, the operator drawing it out with every upward stroke, placing it in position again to meet the downward stroke, which is continued until the whole hide is softened. The machine makes about seventy strokes per minute, steaking from four to five hides per hour. They are then dampened, the lumps, if any, taken off by a shaving process, and then slicked. The slickers are made of steel, stone, glass, the blades of which are about one-half inch in thickness, six inches in length, and about two inches in width, the bottom of the blade being flat. The hide is spread out on a marble table, the operator passing the slicker over it, the action of which smooths it out. Sixty hides can be slicked daily. It is then sponged over with neat's foot oil and hung up to dry. After drying it is cut up into lace. The hide is fastened to a hook at the end of the table and the cutting instrument gauged to the right width. The operator then forces the end of the knife blade through the hide, drawing it along the whole length. This operation is continued until the whole hide is cut up into lace. The strips of lace range from one-fourth inch to five-eighths inch in width and from five to ten feet in length. Forty to fifty strips of lace can be cut from a side. A good hand can cut forty sides into lace per day. The sketches were taken from the plant of F. Guenther, Newark, N. J.



MANUFACTURE OF BELT LACING.

Soft Coal Without Smoke.

Mr. C. M. Higginson, an expert Chicago engineer, in a paper on the abatement of the smoke nuisance, gave the following rules as essential to good combustion:

1. A good draught.
2. Open grate bars.
3. Means for supply of air above the fire.
4. Means for mixing the air with the volatile gases.
5. Distance in which to complete the combustion of the mixtures.

Mr. Higginson says the grate bars should have air spaces equal to fifty per cent of the grate, and that unrestricted space of 20 feet is needed for the flame. With an 18 foot boiler this can be secured. For locomotive boilers and tugboat boilers a combustion chamber should be placed midway between the tubes. In no case should the draught for the flame be direct from the fire box through the tubes, for the temperature in the tubes rarely rose above 320 degrees, and 1,500 degrees was requisite for the combustion of the volatile gases, which was the chemical character of smoke.

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The Electro-Deposition of Cadmium.

Smee appears to have been one of the first—if not the first—to deposit cadmium. Since he published the results of his experiments the matter has received little attention, partly due, no doubt, to the scarcity and considerable cost of the metal; it can now be obtained of good quality at a low rate. Its use has hitherto been confined to the production of the yellow sulphide, CdS, as an artist's pigment, and to the aid of the photographer in the form of iodide, $Cd\ I_2$, and bromide, $Cd\ Br_2$. Cadmium melts at the same temperature as tin, an alloy of 3 parts cadmium, 15 bismuth, 8 lead, 4 tin, fuses at the remarkable temperature of 140° Fah., 72° below the boiling point of water, which has led to its being selected for the manufacture of fusible alloys for electric cut-outs. A cadmium amalgam, consisting of 78·26 parts mercury and 21·74 parts cadmium, agreeing with the formula, $Hg_2\ Cd$, can be kneaded like wax at a moderate temperature, and was formerly used by dentists for stopping teeth. Cadmium resembles tin in color and appearance, and is very malleable and ductile at the ordinary temperature. The comparative hardness of cadmium to other plated metals is shown in the following table:

	Hardness.
Nickel electro plate	10·0
Sheffield plate	10·0
Antimony electro plate	9·0
Palladium (deposited bright)	8·0
Platinum electro plate	6·0
Cadmium silver alloy (Cd 60·5, Ag 39·5)	5·0
Cadmium (deposited bright)	4·5
Silver (burnished)	4·0

The figures represent the hardness as registered by the number of grammes weight on a diamond point required to produce a scratch.

Smee obtained good tough deposits of cadmium from an ammonia-sulphate solution, made by adding ammonia to the sulphate and dissolving the precipitate in a very small excess of the precipitant, but was unable to obtain good deposits from sulphate or chloride solutions.

In 1849, Messrs. Woolrich & Russell, of Birmingham, took out a patent for depositing cadmium; they prepared a solution by dissolving metallic cadmium in nitric acid of commerce, diluted with about six times its bulk of water, which they preferred to add at a temperature of some 80° or 100° Fah., adding the diluted acid by degrees till the cadmium was dissolved. To this solution of cadmium they added a solution of carbonate of soda (made by dissolving 1 pound of ordinary crystals in a gallon of water) until the cadmium was precipitated; the precipitate thus obtained was washed three or four times with tepid water, when it was ready for use, various solvents being used, but the one preferred was a solution of cyanide of cadmium, which was added in sufficient quantities to dissolve the precipitate and leave one-tenth of the solution in excess. The best working strength for the solution was found to be 6 ounces (troy) of the metal to the gallon, the temperature of the bath being about 80° or 120° Fah. Bertrand claims to have obtained white adherent coatings from an acid sulphate solution and a solution of the bromide slightly acidulated with sulphuric acid. Cowper-Coles also recommends a strong solution of the double salt of cyanide of cadmium and potassium, as it will deposit the metal rapidly, and in a bright form, a cadmium anode dissolving very freely. Its inertia to chemical action as compared to zinc and brass renders cadmium suitable for coating the terminals and connections of primary and secondary batteries, and for coating small shot (for sporting purposes) and steel bullet jackets, in the one case to prevent the leading of the barrels, in the other the corrosion of the steel. Within the last three years cadmium silver alloys, containing but a small percentage of silver, have been employed for coating the bright steel parts of machines, such as bicycles, and a silver cadmium alloy containing 7·5 per cent of cadmium has been somewhat extensively used for plating domestic articles. Such alloys have been found to withstand the tarnishing influences of the atmosphere much better than pure silver, or a standard silver containing 7·5 per cent of copper.

A silver cadmium alloy, upon being tested with a Thomson galvanometer, was found to be electro-positive to nickel, there being a difference of more than 0·25 E.M.F.; therefore if the alloy is used for coating steel, and the underlying metal is at any time exposed to a chance scratch or abrasion, the corroding action of the air and water is more violent in the presence of the nickel than in the presence of the silver cadmium alloy covering, owing to a more intense electrical action being set up by the nickel. Cowper-Coles' process for depositing the cadmium alloy consists of preparing the electrolyte by dissolving the cyanides of the two metals in cyanide of potassium, the proportions of the two metals being varied with the nature of the deposit sought. To obtain deposits of 10 to 80 per cent of cadmium, it is found necessary to have the ratio of the silver and cadmium in solution in the proportion of from one to four to one to seven, the best results being obtained when the amount of metal in solution is from 3 to 4 ounces per gallon, and the amount of silver per gallon not less than 8 dwts. or more than 25 dwts.; the weaker the solution, the smaller must be the current density employed, and in order to keep the bath from becoming exhausted the anode surface should be greater than the cathode surface, and sufficient free cyanide be always present in the bath to dissolve the cadmium cyanide formed on the anodes. The addition of the carbonates of the alkali metals is found to reduce local action, due most probably to the nascent liberated metal. As the nature of the deposit varies with the current density, attention to the color and general appearance of the deposit on a test plate or otherwise is found to give full control of the depositing process. An experienced plater can judge the composition of the alloy within 1 or 2 per cent, which is found to be near enough for practical purposes.—The Electrical Review, London.

On the Care and Cleaning of Object Glasses.

J. A. BRASHEAR.

So many possessors of telescopes write to me in regard to the care and cleaning of their object glasses that I think it will be of interest to the readers of Popular Astronomy if I give them the benefit of a long experience. There has always been such a halo thrown around the object glass of a telescope that those who own good glasses dread to touch them, and indeed this has partly been the fault of the makers themselves.

In an article on the care of the telescope in the May number of Popular Astronomy, copied from Mr. Gibson's handbook, there are some good suggestions, and some precautions; but I have more faith in any person who can use a telescope with ordinary intelligence than to say to him, "On no account should the two glasses composing the objective be separated or taken apart by the amateur;" on the contrary, I believe every one who owns and uses a telescope should be so familiar with his objective that he can take it apart and put it together just as well as the maker of it, and, as an objective must be taken apart after considerable use, particularly in moist climates, so as to clean between the lenses, I see no reason why the "amateur" or the professional should not be the person to do it.

The writer does not advise the use of either fine chamois skin, tissue paper, or an old soft silk handkerchief, nor any other such material to wipe the lenses, as is usually advised. It is not, however, these wiping materials that do the mischief, but the dust particles on the lenses, many of them perhaps of a silicious nature, which is always harder than optical glass, and as these particles attach themselves to the wiping material, they cut microscopic or greater scratches on the surfaces of the objective in the process of wiping

I write this article with the hope of helping to solve this apparently difficult problem, but which in reality is very simple.

Let us commence by taking the object glass out of its cell. Take out the screws that hold the ring in place, and lift out the ring. Placing the fingers of both hands so as to grasp the objective on opposite sides, reverse the cell, and with the thumbs gently press the objective squarely out of the cell onto a book, block of wood or anything a little less in diameter than the objective, which has had a cushion of muslin or any soft substance laid upon it. One person can thus handle any objective up to 12 inches in diameter.

Before separating the lenses it should be carefully noted how they were put together with relation to the cell, and to one another, and if they are not marked, they should be marked on the edges conspicuously with a hard lead pencil, so that when separated they may be put together in the same way, and placed in the same relation to the cell. With only ordinary precaution this should be an easy matter.

Setting the objective on edge, the two lenses may be readily separated.

And now as to the cleaning of the lenses. I have, on rare occasions, found the inner surfaces of an object glass covered with a curious film, not caused directly by moisture, but by the apparent oxidation of the tinfoil used to keep the lenses apart.

A year or more ago a 7-inch objective made by Mr. Clark was brought to me to clean. It had evidently been sadly neglected. The inside of the lenses was covered with such a film as I have mentioned and I feared the glass was ruined. When taken apart it was found that the tinfoil had oxidized totally and had distributed itself all over the inner surfaces. I feared the result, but was delighted to find that nitric acid and a tuft of absorbent cotton cut all the deposit off, leaving no stains after having passed through a subsequent washing with soap and water.

I mention this as others may have a similar case to deal with.

For the ordinary cleaning of an objective let a suitably sized vessel, always a wooden one, be thoroughly cleaned with soap and water, then half filled with clean water about the same temperature as the glass. Slight differences of temperature are of no moment. Great differences are dangerous in large objectives.

I usually put a teaspoonful of ammonia in half a pail of water, and it is well to let a piece of washed "cheese cloth" lie in the pail, as then there is no danger if the lens slips away from the hand, and, by the way, every observatory, indeed every amateur owning a telescope, should have plenty of "cheese cloth" handy. It is cheap (about 3 cts. per yard) and is superior for wiping purposes to any "old soft silk handkerchief," chamois skin, etc. Before using it have it thoroughly washed with soap and water, then rinsed in clean water, dried and laid away in a box or other place where it can be kept clean. When you use a piece to clean an objective, throw it away. It is so cheap you can afford to do so.

If the lenses are very dirty or "dusty," a tuft of cotton or a camel's hair brush may be used to brush off the loose material before placing the lenses in the water, but no pressure other than the weight of the cotton or brush should be used. The writer prefers to use the palms of the hands with plenty of good soap on them to rub the surfaces, although the cheese cloth and the soap answers nicely, and there seems to be absolutely no danger of scratching when using the hands or the cheese cloth when plenty of water is used. Indeed, when I wish to wipe off the front surface of an objective in use, and the lens cannot well be taken out, I first dust off the gross particles and then use the cheese cloth with soap and water, and having gone over the surface gently with one piece of cheese cloth, throw it away and take another, perhaps a third one, and then when the dirt is, as it were, all lifted up from the surface, a piece of dry cheese cloth will finish the work, leaving a clean, brilliant surface, and no scratches of any kind.

In washing large objectives in water I generally use a "tub" and stand the lenses on their edges. When thoroughly washed they are taken out and laid on a bundle of cheese cloth and several pieces of the same used to dry them.

I think it best not to leave them drain dry. Better take up all moisture with the cloth, and vigorous rubbing will do no harm if the surfaces have no abrading material on them, and I have yet to injure a glass cleaned in this way.

The process may seem a rather long and tedious one, but it is not so in practice, and it pays.

In some places objectives must be frequently cleaned, not only because they become covered with an adherent dust, but because that dust produces so much diffused light in the field as to ruin some kinds of telescope work. Mr. Hale, of the Kenwood Observatory, tells me he cannot do any good prominence photography unless his objective has a clean surface. Indeed every observer of faint objects or delicate planetary markings knows full well the value of a dark field free from diffused light. The object glass maker uses his best efforts to produce the most perfect polish on his lenses, aside from the accuracy of the curves, both for high light value and freedom from diffused light in the field, and if the surfaces are allowed to become covered with dust, his good work counts for little.

If only the front surface needs cleaning, the method of cleaning with cheese cloth, soap and water, as described above, answers very well, but always throw away the first and, if necessary, the second cloth, then wipe dry with a third or fourth cloth; but if the surfaces all need cleaning, I know of no better method than that of taking the objective out of its cell—always using abundance of soap and water, and keep in a good humor.—Popular Astronomy.

Preservative Painting for Metals.

In a paper by Mr. M. P. Wood, read before the American Society of Mechanical Engineers, it is stated that graphite, mixed with pure boiled linseed oil to which a small percentage of litharge, red led, manganese, or other metallic salt has been added at the time of boiling to aid in its oxidation, forms a most effective paint for metallic surfaces, as well as for wood and fiber. Some recent experiments with this paint applied to the surface of boiler tubes show it to be very effective in preventing the formation of scale. Mr. Wood commends the system of requiring all iron and steel intended for structural uses to be pickled and cleansed from mill scale; declaring it to be an absolutely indispensable condition for all material of the kind intended to be preserved from rust by painting. It should then be painted two coats with pure raw linseed oil and red lead, after which the metal will stand the weather for fifty years without further treatment. Mr. Wood gives, for the benefit of engineers, a ready rule, deduced from his own experience, to determine the quantity of paint required to cover any structure. It is as follows: Divide the number of square feet of surface by 200; the quotient will be the number of gallons (American ?) of liquid paint required for two coats. Or: Divide the area in square feet by 18, and the result is the number of pounds of pure white lead required to give three coats, where this pigment is permissible. Red lead paint should be treated like Portland cement —applied to the work fresh, and allowed to take its initial set where it is to remain. A gallon of good red lead paint contains 5 lb. of oil and 18 lb. of red lead; and it will cover for a first coat about 500 square feet, and as a second coat about 600 square feet of surface.

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