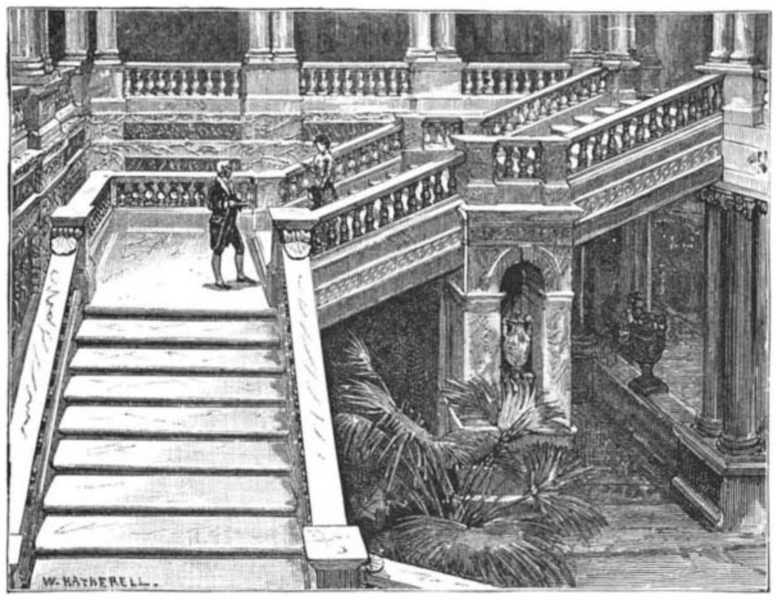
### THE STAIRCASE OF A GREAT HOUSE.

Dorchester House, at Park Lane and Dean Street, London, England, is one of the most remarkable of the many large houses of that great city. It is a modern structure, replacing the old house pulled down in 1839, but the present building possesses the special interest of being the work of a series of artists who each designed his share of the whole. The central feature is a staircase of large dimensions, surrounded on the first floor by a wide corridor communicating with it by arches, the principal rooms being grouped around it on three sides. A visitor, on passing through the entrance hall, enters the lower vestibule, which is part of a wide corridor running transversely across the house, and paved with marbles inlaid in a pattern derived from one of Raphael's cartoons. From this vestibule the staircase is seen between coupled Ionic columns of pink granite, which support the gallery, the view being nearly that represented in our illustration. The marbles lining the walls by the side of the staircase are especially beautiful, being in large panels of a rich dark green, with an inlaid edging of red, the panels being separated from each other by projecting masses of a warm white marble, streaked with dark gray, which form piers carrying the plinths of the coupled columns of the first story. At the top of the stairs is a wide corridor or gallery, the galleries opening on to and surrounding the staircase being characterized by a picturesque grouping of coupled Corinthian columns supporting arches through which views of the different saloons are obtained. The exterior of the building is graceful and refined, though not presenting anything of striking originality.



GRAND STAIRCASE, DORCHESTER HOUSE LONDON.

### A NEW ELECTRIC CURRENT METER.*

BY PROFESSOR G. FORBES.

At the present moment the mind of electrical engineers is much directed to the successful means of distributing electricity to a large district from central stations by means of that class of induction apparatus which has received the several names of "secondary generator," "transformer," and "converter." This is the only thoroughly worked out system available to the engineer for an extensive supply of electricity. Currents of an alternating character (*i. e.*, alternately positive and negative in direction, the alternations being at the rate of some hundreds per second of time), and of high tension or pressure, are by this system carried from the engine house, by comparatively thin and cheap wire conductors, to the points of supply. The only difficulty which has been met is in the designing of a suitable meter. There is absolutely no meter available that pretends to be reliable. The very best indicates a totally different result when the same current is passed through it, if the number of alternations of the current (*i. e.*, the speed of the dynamo) be altered. It was to overcome this source of trouble and to remove the last difficulty from an otherwise perfect system of electric distribution that the author undertook the labor of designing and perfecting the meter here described. Some idea of the work expended in bringing it to its present state of perfection will be gained when it is stated that the trial observations during the development of the instrument number nearly 10,000. Seeing that the only electrical actions available were those of chemical action, electro-magnetic action, and heat, that the chemical method is incapable of being used with alternate currents, and that all electro-magnetic meters must vary in their indications with the rapidity of the alternations, the author was led to base his instrument on the heat developed by an electric current. Such an instrument must be equally applicable to continuous currents and to alternate currents, whatever their rate of alternations. Thus a meter is obtained which is practically perfect and more simple in construction than any of those designed for a more limited range of uses.

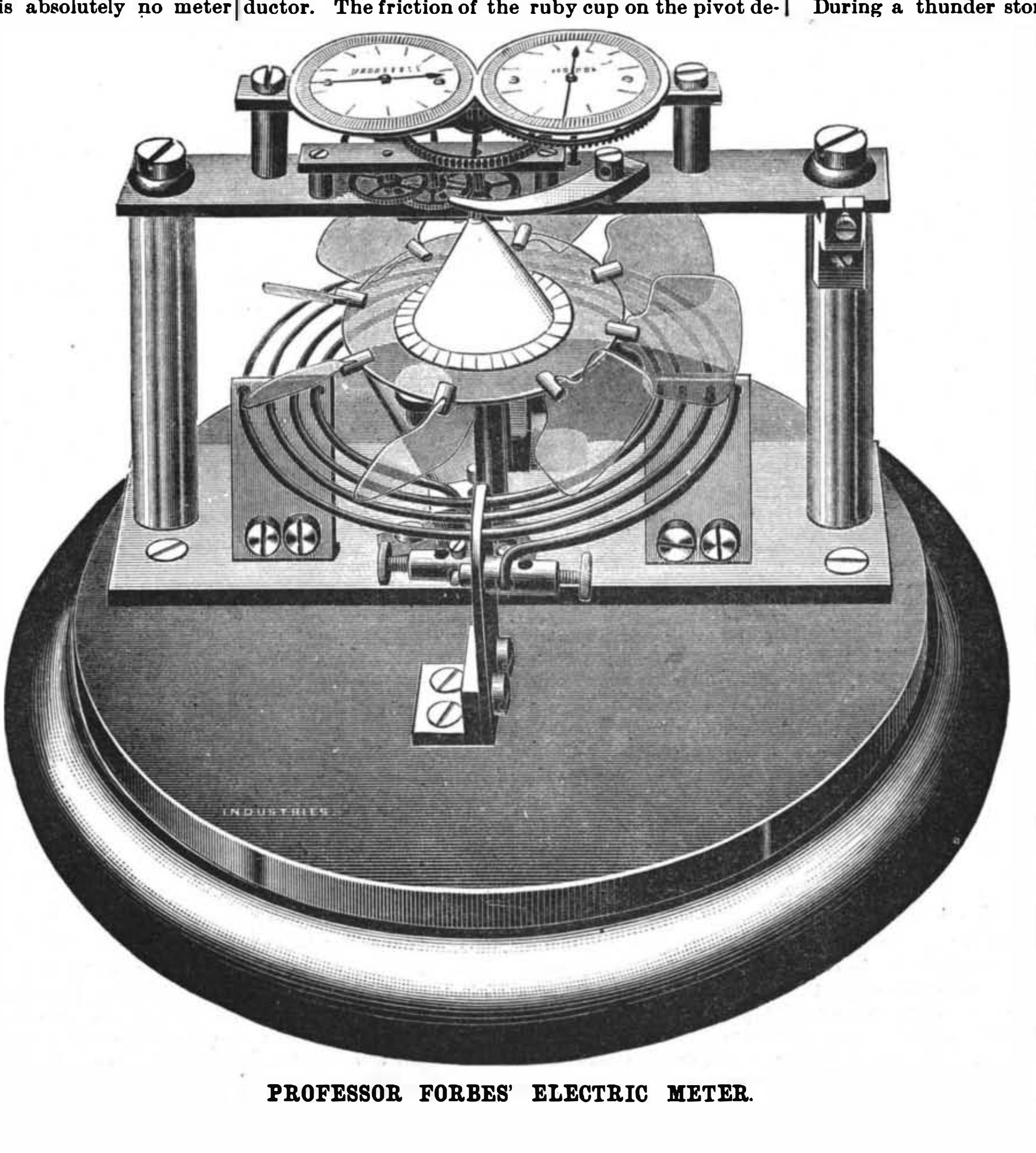
The instrument is extremely simple, both in principle and in construction. It consists essentially of a flat spiral of iron wire with two terminals. Sometimes these two terminals are united to form one, the other being attached to the middle of the wire. Thus the instrument exhibited may be used as an accurate measure for currents from half an ampere or from one ampere upward. Above the conductor a set of vanes is pivoted. This consists of a circular disk of mica with a hole in the center, in which is fixed a pinion with a concentric ruby cup. Round the circumference of the mica disk eight small cylinders of pith are fixed at equal distances, and eight vanes inclined at 45° to the mica disk are attached to the pith cylinders, these vanes being made of the thinnest mica. This set of vanes is supported with the ruby cup resting on a steel point fixed to the base of the instrument. The pinion engages with the first wheel of a train of clockwork actuating the indices, which show upon two dials the number of revolutions made by the vanes. The action of the instrument is very simple. The electric current passing through the iron conductor creates heat, which sets up a convection current in the air, and this causes the vanes to rotate about the vertical axis and drive the clockwork. The number of revolutions indicated on the dials is, through a considerable range of currents, an exact indication of the number of coulombs or ampere hours which have passed through the conductor. The friction of the ruby cup on the pivot determines the smallest current which can be accurately measured, and the friction of the clockwork is imperceptible. The following table shows the performance of one of these vanes. The conductor used had a resistance of 0·1 ohm. The first line shows the rate at which the current was flowing through the conductor. The second line gives the ratio of current to speed of rotation, a ratio which ought to be constant.

| Current in amperes | ·25 | ·35 | ·45 | ·6 | ·75 | 1 | 2 | 3 | 6 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|
| Ratio of current to speed | 76 | 61·25 | 50·4 | 51 | 50·75 | 51 | 51 | 50·7 | 51 | 51·8 |

When using higher currents, the ratio is equally constant.

Sir William Thomson complimented the author on having practically solved a problem on which he himself had been working for a long time, but not with the same satisfactory results. He was nevertheless extremely pleased at the success achieved by Professor Forbes, because with the invention of a good and reliable meter one of the obstacles to central station lighting had been overcome. The difficulties of making a meter to correctly record alternating currents were very great, one of them being due to the action of the current upon itself. Even in continuous current instruments a slight variation in the strength of the current will sometimes cause an error due to self-induction. Thus, in one of his current balances, the slight variations in the speed of the engines introduced an element of error. Professor Forbes had, however, succeeded in devising a type of instrument in which the self-induction can be made as small as desired, and thus a degree of accuracy to within two or three per cent might be obtained, which is quite sufficient for practical purposes.

After several questions from other speakers, Professor Forbes replied that he found absolutely no difference in the working of the meter, whether it was traversed by an alternating or a continuous current. In fact, an alternating current seemed to introduce less apparent resistance than a misdirected current rapidly made and broken. The size of the glass cover he found to be of importance, the larger cover allowing the mill wheel to start with a smaller initial current. An instrument intended for a maximum supply of twenty lamps would start with half the current strength required for one lamp, and would register correctly from one lamp to twenty. The wheel work does not introduce any appreciable friction.



PROFESSOR FORBES' ELECTRIC METER.

* Read before the British Association, September, 1887. From *Industries*.

### Water Works Struck by Lightning.

During a thunder storm on August 24, the water tower of the water works at Mount Vernon, N. Y., was struck by lightning and damaged, a hole being made in the side which allowed a considerable quantity of water to escape with great force. The supply was checked until the necessary repairs can be made.—*Sanitary Engineer.*

[At the time of the above alleged stroke, we sent an assistant to examine the structure, thinking it rather strange that so excellent a conductor as an iron tower, about 100 ft. high, well connected electrically with the earth, should be damaged by lightning. As a result of our inquiry, we learned that about three hours after the thunder storm above mentioned a small leak was discovered in the side of the tower about 65 ft. from the ground. The leak consisted of an empty rivet hole, through which the water was spurting. Our conclusion was the hole had been filled by a defective rivet, the inner head of which having fallen off, the water pressure then pushed out the bolt. There were no visible signs of any lightning stroke.—EDS. S. A.]

THE easiest way to make holes through an oyster or clam shell is to drill the holes with a hard, sharp steel drill, the same as used for drilling iron. Use the drill dry.

### Building Sites and Choosing Houses.

A writer in a recent number of *Chambers's Journal* makes the following good suggestions to persons about to build or purchase a house. In selecting a house, or a site for a new one, remember that where the sun will shine on the house for some hours a day, one element of good is secured, especially if the sunshine enters at the windows of the living rooms or rooms most used during the daytime. After the aspect has been found to be suitable, and that a plentiful supply of sun and air is insured, attention should be given to the general position and construction of the house. If the ground is at all porous, a layer of concrete not less than six inches thick, and composed of cement or lime and broken bricks or gravel, should be spread over the whole of the ground covered by the building. This will prevent the passage of ground air up through the floors. Air will travel through the ground for some distance, and, as it invariably becomes contaminated by taking up carbonic acid gas in its passage, is not suitable for inhaling. The house acts as a sucker on the ground; and if, unfortunately, the site is one on "made" ground—that is, composed of all the refuse of a town—the ground air becomes the medium of disease. No houses should be built without a well-ventilated air space between the earth and the ground floor, especially if the layer of concrete on the surface be omitted. The walls should be built of good hard-burnt bricks or non-porous stone set in lime or cement mortar. Common underburnt bricks or porous stones hold moisture, which evaporates with a rise in the temperature, and so chills the air in the house. If the bricks or stones of the walls are suspected of holding moisture, the whole of the external surfaces should be covered with cement, or tiled or slated above. The foundations of the walls should rest on thick beds of concrete bedded in the earth; and to prevent the ground damp rising up the walls, a damp-proof course of slates in cement or a bed of asphalt should be laid in the full thickness or width of the wall just above the ground line. Dryness in this climate is so essential to health that any building which in its floors, walls, or roof sins by admitting moisture should be rejected as a place of residence by those who value their health. In tropical climates buildings are constructed to keep out the heat; but here, we build to retain the heat and keep out the cold.

### The Gas Hammer.

Mr. Dugald Clerk recently read a paper before the British Association on "The Tangye Gas Hammer." This hammer is the invention of Mr. James Robson, and was exhibited at the Inventions Exhibition in 1885. Since then it has been continually in action at Cornwall Works, Birmingham. It has been much simplified and improved in its details, and is as reliable and controllable as any steam hammer. It resembles a steam hammer in design, and contains a piston, a piston rod connecting with the top containing the hammer, and an anvil block. The cylinder, however, is longer, and a space is left above the hammer piston to contain the necessary charge of gas and air. A second piston is arranged to fill and discharge the explosion space. The impulse for the blow is given to the hammer piston by the explosion above it, and the return of the hammer to its highest position is effected by means of a voluted spring. When out of action, therefore, the hammer always remains up. The charging piston is actuated by a hand lever, and is an easy fit in the cylinder. When the hand lever is moved in one direction, the charging piston moves downward toward the hammer piston, and the products of a previous explosion pass through automatic lift valves in it to the upper side. On the return movement the charging piston rises, and the automatic valves, closing, cause the spent gases to be discharged at a port in the top of the cylinder, while a fresh charge of gas and air is drawn in between the pistons. At the upper extremity of the stroke the charging piston covers the exhaust port, and then an igniting valve opens to effect the explosion. The hammer descends, strikes its blow, and when the hand lever is moved to transfer the exhaust gases again, the spring returns to its upper position. This is the complete cycle of action. The band lever actuating the second or charging piston is arranged to move precisely like the hand lever commonly used in steam hammers for controlling the slide valve. The similar movement produces precisely similar results, and the effort required is no greater. The blows can easily be given at the rate of 120 per minute. To reduce the force of the blow, the hand or foot is moved through a smaller range and a smaller volume of explosive mixture drawn in, and therefore a more feeble explosion obtained. For very light blows a relief valve is opened to discharge a portion of the pressure. The energy of the blow may be determined in two ways—first by taking an indicator diagram, and second by measuring the velocity acquired by the hammer before it strikes the forging. Diagrams so taken proved the maximum pressure to be 56 lb. per square inch above the atmosphere, and an average of 22·5 lb. during the whole downward movement of the hammer piston. As the cylinder is seven inches in diameter and the fall of the hammer 6 inches, this amounts to 433 foot pounds, which, after adding on the energy due to the fall of the hammer and deducting that due to the resistance of the springs, becomes 406 foot pounds, or 3·62 cwt. falling through 1 foot. This is the case when the hammer cylinder is cold. When hot, the average driving pressure falls to 20 lb. per square inch, and the blow to 3·19 cwt., falling through a foot, or 358 foot pounds. The gas used is 1 cubic foot for 94 of the latter blows. Birmingham gas, with which these experiments were made, costs 2s. 6d. per 1,000 cubic feet, or 33 cubic feet for 1d., and $33 \times 94 = 3{,}102$ blows are thus obtained at the cost of 1d. This is an exceedingly economical and satisfactory result. The paper concluded with a statement of the several purposes to which this hammer can with advantage be applied.

### A Woman Gardener.

Madame De Rostaing, at Seillans, in the Department of Var, France, has a flower farm of about 23 acres, located on the southern slope of the Maritime foothills, about 2,000 feet above the level of the Mediterranean and perhaps 20 miles from the coast, so writes United States Consul Mason, at Marseilles. The calcareous soil was naturally thin and poor, and the olive trees, which had occupied the ground for a century or more prior to 1881, yielded but scanty and unsatisfactory returns. The slope of the surface was so steep that the waters of a spring which flows from the rocks above the track could be but imperfectly utilized for irrigation, and the land was regarded as practically worthless. In 1881 the proprietress caused the olive trees to be removed and the land prepared for flower culture. First, the ground was dug up to a depth of 4 feet, the larger stones were removed and built into sustaining walls for the terraces, into which the surface was divided and leveled. Along the upper margin of each terrace a shallow ditch was cut, connected with transverse channels, which supply the spring water for irrigation.

The abruptness of the slope will be indicated by the fact that on the tract of 18 acres the terrace walls required to produce a series of level or gently sloping surfaces are 2,166 yards in length. Thus terraced, the tract yielded 17½ acres of prepared ground for planting. In the autumn of 1881, 45,000 tufts of violet and 140,000 roots of the white jasmine were planted. The following spring the remainder of the ground was planted with roses, pelargoniums, tuberoses, and jonquils, and a laboratory erected for the manufacture of perfumes. The position proved to have been well chosen, the plants grew vigorously and strong, and in 1885, the fourth year after planting, the flower farm at Seillans, which had previously yielded a rental of $115 a year, produced, according to the statement of the proprietress, perfumes valued at $43,150, giving a net profit of $5,750. The difficult nature of the ground had made its preparation unusually laborious and expensive, but in the foregoing balance sheet for 1885 interest on the entire investment is included in the expense account, so that the profits as stated purport to be clear and legitimate.

### Modern Guns.

General S. V. Benet, Chief of Ordnance, U.S.A., was lately interviewed by the New York *Herald*, and is quoted as saying:

"We have now twenty-five of the new steel guns ready, and twenty-five more will be ready in a few months. That will be sufficient to arm all our light batteries with breech-loading guns. The steel for these guns was supplied by the Midvale Foundry, of Philadelphia.

"All modern steel guns are of one of two systems—either the Krupp bolt system or the 'interrupted screw' used in the French service. Our guns are of the latter system, which seems to offer the greatest advantages. Like all good modern inventions, it is an American one. So, for that matter, is the Krupp, or, rather, what gave Krupp's invention the practical value. The great trouble with the Krupp gun was the escape of gas at the breech. This was overcome by the aid of the 'Bradwell plate,' the invention of Colonel Bradwell, an American, who sold Krupp the invention. It consists of a thin steel plate, with elastic edges, that fits into the breech, and the pressure of the gas wedges it tightly against the sides and prevents the escape of gas.

"Our new field guns weigh 800 pounds, and drive a shot of about twelve pounds in weight by means of 3½ pounds of powder. The caliber of these guns is 3·2 inches. In old days a pound of powder was considered sufficient for a twelve pounder, but these new guns carry two and a half miles. At least we think they will, for they have not yet been thoroughly tested in this respect.

"The carriages for these guns are not yet ready. They will be of steel, and will be, when finished, the handsomest gun carriages in existence. Our great object was to combine lightness and solidity.

"The largest guns now in existence are the four great 125-ton guns Krupp made for the Italian government. They are intended for coast defense, and are now, I believe, at Spezia. When Krupp tested these guns before the Italian board of officers he fired one of them eighty times himself.

"Whitworth was for a long time supposed to make the best steel. His process is to condense the steel by subjecting it to a tremendous pressure while in a semi-fluid state. A Whitworth tube will under this pressure be shortened about one-eighth of its original length. Other manufacturers obtain this result in a minor degree by hammering. Armstrong at first made his guns of hammered iron, so far as the tubes were concerned, with steel hooping, but now his guns are entirely of steel, as the others. We have not a single breech-loading gun on our coast.

"The American infantry soldier fires 800 rounds a year—about ten times as many as the soldier of any other nation uses in the same time. This amount of practice makes them the best marksmen in the world. We have an army of marksmen.

"The board of officers before whom the new inventions in magazine guns were tested selected three for experiments to be made by troops in the field. These were the Lee, the Chaffee-Reese, and the Hotchkiss. The army report was unfavorable to them all, the verdict being that the present Springfield rifle was the best rifle for the frontier.

"But could troops armed with the Springfield hold their own with troops armed with a magazine gun?

"No; for in every battle a time must come when the soldier shall be able to discharge his piece five or six times in a few seconds. Every magazine must be detachable. With the Lee this was the case. With the others it was not. It must be detachable, because until at close quarters the firing will be more effective with a rifle loaded in the ordinary way without the incumbrance of a magazine.

"A new problem with the present system of rapid firing is how to get ammunition to a skirmish line. There is danger in the present system of ammunition boxes, containing 1,000 rounds and tightly nailed up. The soldier, having difficulty in opening it, not infrequently dashes the box against a tree to break it open. We have invented a box that overcomes this difficulty. It is watertight, opens readily, and is perfectly safe to handle."

### Dangers of Electric Light Wires.

At Lincoln, Neb., on September 21, a workingman named Smith was horribly mutilated in a remarkable manner. On O Street, at the corner of Ninth, hanging from a telegraph pole and lying along the ground for a distance was a broken telephone wire, which had in some manner become crossed, or in connection with one of the electric light wires. As Smith was passing along the street he saw the wire burning, and, attracted by the strange appearance, and not realizing what it was, evidently took hold of it to ascertain what it meant. The shock he received was terrific, and his shrieks brought hundreds to the street. He could not loosen his hold on the wire, and it burned his hands to the bone. In his writhings and contortions the charged wire came in contact with his head, burning out one of his eyes and laying the side of his face open. Wherever it struck his body it cut like a knife. A bystander, realizing the peril of the man, ran to him, grabbing him to pull him from the wire, but by the shock he received when he came in contact with the body of the man he was knocked ten feet into the street and utterly prostrated, so that it was feared he was also killed. By this time the electricity had either burned the man Smith loose from the wire or he had succeeded in his struggles in breaking away. He was picked up and carried into an adjoining restaurant and a half dozen physicians summoned. The man presented a horrible appearance, and despite the physicians' efforts to put him under the influence of morphine he shrieked and writhed in the agony he suffered until taken to the hospital. The doctors express the opinion that he may survive his injuries, although it appears impossible.—*Kansas City Journal.*

### Quartered Lumber.

A few years ago there was little if any lumber sawed quartered, or with the grain. Now not only oak but many other woods are being sawed more and more in that manner. Any consumer of lumber will tell you that it is far the better way to manufacture. We now have oak, poplar, gum, and sycamore in large quantities thus sawed. It costs more to saw quartered stock than plain, but it is much more valuable. The waste is considerable. Take a 24 inch 12 foot log, clear and straight, and 75 per cent of it will make good quartered firsts and seconds if properly managed. Probably no wood except oak has so grown in popularity as quartered poplar. It is used plump inch, six inch, and up wide, and immense quantities are now used by piano manufacturers. There is a scarcity of it, and any one who finds plain poplar dull and hard to sell should quarter-saw his stock. The *Northwestern Lumberman* says it is worth from $2 to $5 a thousand more.