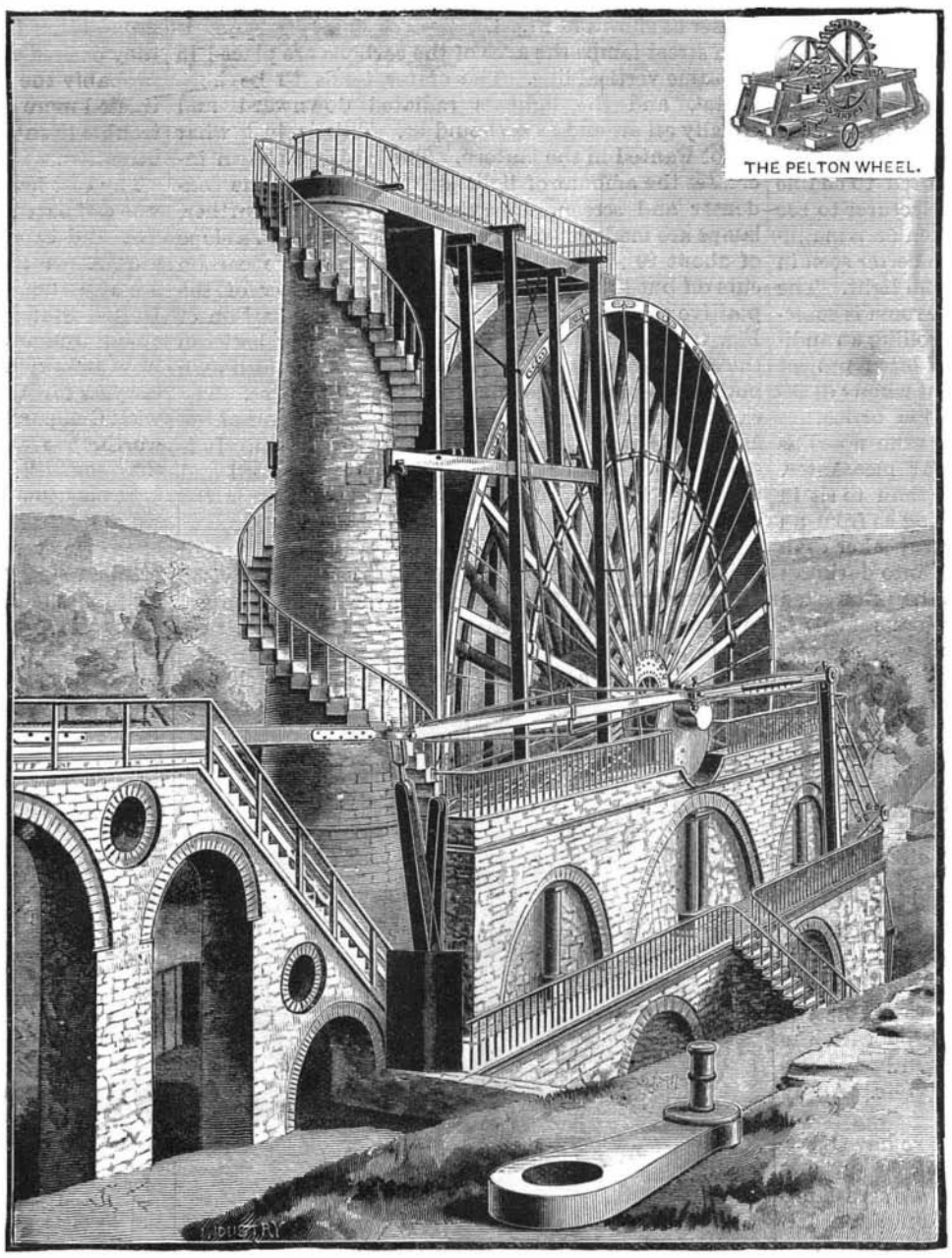
THE LARGEST AND THE SMALLEST WATER WHEEL.

The overshot water wheel shown in the accompanying illustration has the reputation of having been the most costly to build as well as that of being the largest water wheel ever constructed. It is at Laxey, on the Isle of Man, where it is used to pump water in working a lead and silver mine. The wheel is 72 ft. 6 in. in diameter, 6 ft. in breadth, has a crank stroke of 10 ft., and develops about 150 h. p. The power operates a system of pumps raising 250 gallons of water per minute, the lift being 1,200 ft. The power is transmitted several hundred feet to the pumps by means of wooden trussed rods, supported at regular intervals, the supports resting on small wheels, running on iron ways, to lessen the friction. The water to turn the great wheel is brought from a distance in an underground conduit, it being carried up the masonry tower by pressure. This great wheel was constructed some forty years ago, and has been running continuously ever since.

In the upper right hand corner of the same picture is represented another water wheel, drawn to the same scale, and which will afford as much power under similar conditions of head and water supply. This small wheel is the well known Pelton, having peculiar cup-shaped buckets on the periphery of the wheel, into which the water is so directed from one or more nozzles that nearly the full value of its weight for the height of its head or fall is transformed into the inertia of the wheel. The power represented by the force of the water is thus converted into mechanical movement, almost entirely without friction, "the buckets simply taking the energy out of the stream and leaving the water inert under the wheel." The Pelton wheel is extremely simple in construction, and is in size and appearance apparently but little more than a mere toy, in comparison with the ponderous piece of machinery shown as the great Laxey wheel, with its massive column, arches and stone foundation. Probably the cost of putting in position a Pelton wheel to afford the same power as this great overshot wheel would not be one-fiftieth of that of the earlier and cumbersome construction. Such an object lesson is of value in showing the wonderful progress in hydraulic engineering practice during the last half century.



THE GREAT OVERSHOT WATER WHEEL AT LAXEY ISLE OF MAN.

ELECTRIC LIGHT FOR MAGIC LANTERN.

PROF. W. C. PECKHAM.

There is great diversity of opinion regarding the candle power of both the calcium and electric arc lights. Makers and dealers in the calcium light claim as high as 900 candle power for it as actually used in the lantern. I have made numerous measurements in the laboratory of the Adelphi Academy upon both. The method employed was that of the Bunsen grease spot photometer, with a sight box by the American Meter Co. The standard of light was the Sugg London standard Argand gas burner and a Methven screen, by the same company. These have been compared with standard candles and are correct, or what is called so. The following table is compiled from my notes, each jet being tested three times. 1. A noiseless flame. 2. A medium flame making as much noise as would be allowable in the lantern. 3. A roaring flame, taking all the gas it will use.

CALCIUM LIGHTS.

Jet.	1	2	3		Jet.	1	2	3	
A.....	304	304	413	candles.	D.....	264	304	353	candles.
B.....	130	205	413	"	E.....	180	...	304	
C.....	264	304	491	"					

Column 3 gives the maximum beyond which these jets cannot be forced and which they cannot long maintain, since the lime would soon crumble away under such a bombardment.

A calcium light which had just been tested with a quiet flame was used as a standard by which to measure the candle power of the two arc lights for lantern use belonging to the Adelphi Academy, with the results given below.

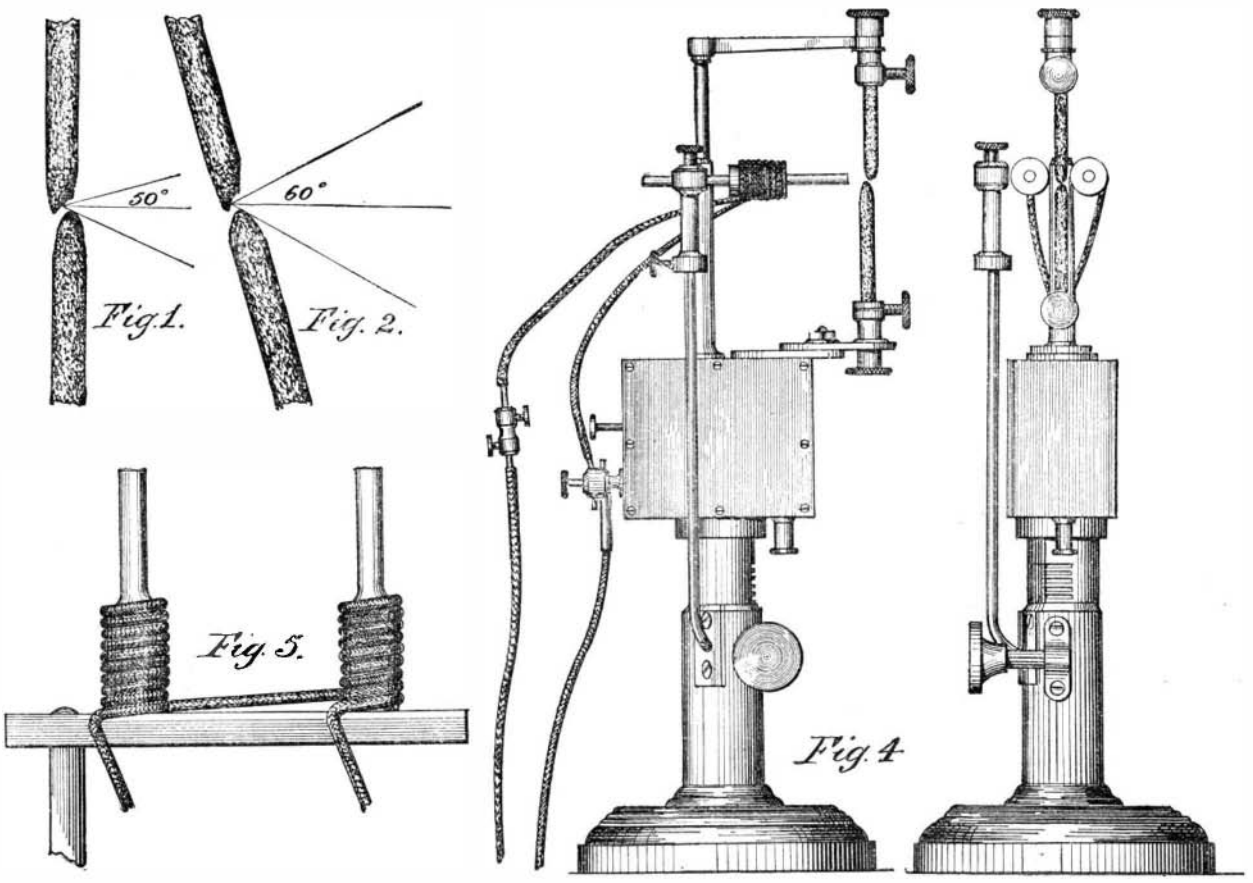
A small lamp made by the United States Electric Lighting Co., requiring about 8 amperes at 110 volts, gave 355 candles. A Clark lamp of full capacity with a current of about 15 amperes gave 1,378 candles, and with a full current of 20 amperes on gave 1,758 candles. These figures show that candle power is much overestimated in all cases. The last lamp measured is what is called a 2,000 candle power lamp. It gives in the condition in which it would be used 1,300 candles, and this is a magnificent output when compared with the 300 candles of the calcium lights.

In many places current can now be had from lighting and power circuits, while many educational institutions have their own plant, which could easily be employed for this purpose, but as yet no arc lamp of moderate price equal to the work has been put upon the market. Not to mention the old regulators, like the Foucault, with clockwork which requires frequent winding, there are several lamps costing about one hundred dollars made for this use, but that price for the lamp alone is prohibitory to many. English writers recommend the Brockie-Pell lamp most highly. The Clark lamp, spoken of above, is a favorite here. It, however, is hung down into the lantern, resting on the top of it. Its regulating magnets and mechanism are heavy, rendering the whole somewhat topheavy. To adjust the light one must reach above the top of the lantern, and if the lamp is to be removed from the lantern, a special stand must be provided for it. The lamp I have used for nearly two years was made by the United States Electric Lighting Company. It is simple in construction, rising by a rack and pinion by hand, as the lower carbon is consumed to bring the arc into focus again. Its fault is that it does not "take up" quickly when the current varies through varying resistance in the arc. With a little experience its regulation by hand, to overcome this defect, is not difficult.

Fig. 4 shows the appearance of the lamp and its interior mechanism, the sides being removed for that purpose when the photograph was made. It stands 20 inches high, with full length of carbons.

It would seem that a focusing lamp might be made for a moderate price which would, with plain, strong, and durable workmanship, be as good practically as the highest priced lamp, and that such a lamp would find a good market.

The incandescent lamp has been used in the lantern by some. In its ordinary form with a long loop of filament the light is too widely distributed. A special form has been made for the lantern of 100 candle power. The carbon filament was coiled into a close spiral of about a half inch in diameter, which is about the size of the white spot on the lime. This lamp is very easy to use, since its resistance would be fitted to the circuit upon which it was to be put, and it would run with the other lamps upon the same circuit and with no more attention. The operator has nothing whatever to do but to turn the key when the light is wanted. Where its light is sufficient nothing better can be desired, nothing cheaper be found. The lamp itself costs very little, and a support for it in the lantern can be made by any one. It is infinitely better than any



ELECTRIC LIGHT FOR THE MAGIC LANTERN.