multiple cylinder engines, until the strength of the steam current is exhausted, after which it is passed into a condenser, bringing the atmospheric pressure into action as a further source of power. These machines, as constructed by Parsons Bros, of Newcastle, very nearly come up in economy of fuel to high-class engines. Their lasting properties under constant loads have, I think, yet to be demonstrated. The heavy work in connection with the Portsmouth plant is performed by direct driven Terranti dynamos, these dynamos, etc, possess three essential points of novelty:

1st. The dynamos being mounted on the fly-wheels of the engine, and running at the slow speed of 90 revolutions per minute.

2nd. The arc lighting being done by a continuous or direct current, transformed or rectified, feeds from the alternate current.

3rd. The method of distributing the current by automatic change-over converters, which allows a very high efficiency to be obtained.

The Portsmouth installation is the first on this system, as a whole, in any part of the world, and has been proved to have great advantages not hitherto brought into operation. The saving by the system in capital outlay and working expenses is very great; while the lights, both arc and incandescent, are pronounced to be the steadiest and purest known.

The wheel dynamos are not a novelty, as they have been previously adopted. The difference in the Portsmouth is in the remarkable simplicity of their electric parts; in fact, so mechanical is this machinery that it is difficult to those not initiated to find out where the electrical part begins, for a practical machine for everyday work is to make it as simple mechanically and electrically as is consistent with efficiency. The arrangement of the Terranti dynamos is such that there is no part carrying the high pressure current in any way exposed It is impossible for any person, even if so disposed, to receive a shock from any part of the machinery whilst running, the working parts being entirely enclosed by metal work. They and the insulation surrounding them are fully protected from damage or deterioration, so complete is this protection that no harm would take place should water or oil be dashed over it These are sources of danger to the ordinary dynamo as now built.

Each dynamo consists of a number of magnets bolted around the fly wheel of the engine; these are wound with solid copper strips formed into coils by means of special forms, and left bare. Unlike the ordinary copper winding in other dynamos, the exciting current is passed through these coils, and is of so low a pressure that it is absolutely harmless. The magnets surrounding the fly-wheel act upon the armature of the dynamos, which is carried by a large circular casting surrounding the magnets. The armature consists of a quantity of thin plates of wrought iron formed into segmental blocks, the electric conductors pass back and forward through holes on the blocks, and are connected to the ends on stout gun metal boxes, and are run on solid by an insulated point, the electrical part being thoroughly insulated. The electricity is generated in this armature up to 2,800 volts, to be increased or diminished by step down or step up transformers as may be desired. Each machine is capable of lighting 6,000 16-candle power incandescent lamps and 100 arc lamps of double the capacity of ordinary street lamps. The dynamos are driven by means of compound Corliss engines, now coming into general use in England and the European continent for this purpose. There can be no question as to the fact that for general factory and electrical purposes that the Corliss engine is the best in existence when carefully designed and well built. Such is the opinion of most European engineering circles, when not interested in some other design. This has been fully realized in the three compound Corliss engines running in the Plymouth power-house so far as tested.

The second point with the Portsmouth plan different to others is that the arc lamps are run with a continuous current obtained from the main alternating circuit and rectified into a continuous current. Up to the present time, as nearly all electricians know, the plan adopted has been to place a number of lamps, varying from two or three to fifty, upon a single circuit coupled in series, the same quantity of current passing through every lamp one after another, this current being obtained from what is called an arc dynamo This system has hitherto given the best results, and has been generally applied The difficulty attending it is that each machine will only, at the most, light fifty arc lamps. Therefore, for an installation of large size, a large number of machines are required. In order to make a proper duplicate of the plant it has been convenient to run each machine with a separate engine, in fact many electricians and engine builders have claimed that this is the only correct system to run arc lights from. Further, the speed of these dynamos is too high to run them direct, necessitating pulleys, shafts, ropes or belts, with the attendant losses from friction, oil and attendance. In order to obviate these difficulties some have endeavored to run these arc lamps from the alternating current, but this has in every instance proved so unsatisfactory that arc machines on continuous current had to be substituted for the Alternate or Portsmouth Arc Incandescent and Motor Power Arc taken from the main alternate current cable.

In Portsmouth they combine the advantages of both these systems without the disadvantages. The lights have all the steadiness of the continuous current in the arc lamp and the alternate in the incandescents.

The system adopted is to take the alternating current from the main supply at the station, and by means of constant current transformers and rectifiers to change the alternate into a continuous system of the right amperes and voltage for feeding a circuit of arc lamps. Four of these sets of apparatus are now in position in Plymouth, capable of supplying 47 arc lamps each; there is therefore supplied a pure continuous flow from alternating current without the erection of extra dynamos, driving belts, ropes, shafts, bearings, etc, steam exhaust and other pipes. The great saving in this plant is that the current is obtained cheaper from the big compound Corliss engines and dynamos than it can be from smaller engines and dynamos that the large amount of ordinary attention necessitated by small engines, small dynamos, shafts and belts is done away with, and the valuable space in city stations retained for further use The cost of repairs and maintenance is very materially reduced, as the wear and tear of small engines and dynamos running at high speed is very great as compared with Corliss engines and fly-wheel dynamos The arc and incandescent lights in Portsmouth, it is claimed, are vastly superior to those in general use in England; as high as 50 per cent of advantage, photometrically, is insisted on for the arc lights.

The third point of novelty in the Portsmouth plant claimed for the system is the transformer, or the change over converters, as they are called They change-over the high tension alternate current into the low pressure continuous, which feeds the mains supplying the various consumers of incandescent lights and the motor powers of the city; the two great systems at work up to now have been the high tension or alternating current, and the low tension continuous current, each having great advantages and corresponding disadvantages, which it has for a long time been the endeavor of electricians to overcome. The continuous low pressure system is very economical and generally satisfactory where a very small area has to be lighted, and when the demand is so great as to put up several central generating stations; its advantage is that it is possible to consume a much larger portion of electricity generated than by any other means, because there is less loss between the current generated and that supplied to the consumers. The great disadvantage is the very small distance that it is possible to distribute light and power through the mains, on account of the very low pressure at which the electricity is generated and distributed. This necessitates the generating stations being small We are all well aware of the fact that it is more expensive to run several small stations than one large one to do the same amount of business. Again, the amount of copper required in the system for a low tension system is very great, requiring a heavy expenditure and a large amount of regulating to ensure constant pressure and an even current to the lamps. The alternating system is the reverse of this. One generating system is capable of supplying an area of almost any probable size, and consequently greater economical results; the current can be conveyed to a great distance by small mains. The alternating current dynamos are more mechanical in construction and substantial, and the general workableness of the system, all that could be desired; it suffered, however, in the loss in working the transformers as hitherto constructed. They are all right when under a full load and entirely turned off during the day, or when only a small amount of light is desired. As this is not practical, some people requiring a single burner for the 24 hours, they have in this way remained a source of serious loss. The system at Portsmouth is quite different from anything that has hitherto been done commercially, and consists in transferring the high pressure current into a domestic supply current by means of transformers placed under the side walks. These transformers are specially designed: they are so wound that they adapt themselves automatically to an electric supply of the highest possible efficiency under all conditions. That is to say, that they are not only efficient when supplying a large amount of light, which only occurs a short time, but they are equally efficient and economical under a small number of lights, and when a small amount of current is being taken. So good is the economy of this type of transformer that it almost entirely corresponds with the continuous current system. This is, there-