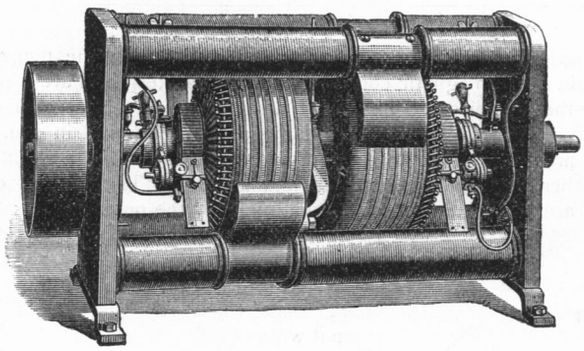
BALL ELECTRIC-LIGHTING SYSTEM.

ONE of the most peculiar of the many dynamos that have been used or proposed for arc-lighting is that of the Ball Electric Company. From the accompanying illustration it will be seen that two armatures are mounted on the shaft, with one pole-piece for each.



THE BALL DYNAMO.

The armatures are of the well-known Gramme ring type, and are constructed with a large number of separate coils, thus reducing the sparking at the commutators to a minimum. By some it is claimed that the dynamo must be at a disadvantage from the considerable magnetic resistance that the lines of force experience in passing from pole-piece to pole-piece. By others it is said that this is not so, as the lines of force do not close their circuit from pole to pole, but from poles through armatures to magnet-bars opposite; and that from the thinness of the copper windings, and from there being two armature-cores in multiple across a common field, the magnetic resistance is actually less than in other makes of dynamos. The large output of the dynamo in comparison to its weight, and the small amount of copper used upon its field, seem to testify to the correctness of the latter.

Its advantages, which are of a practical kind, lie in the fact that by distributing the rotating wire on two armatures the number of layers can be reduced, the difference of potential between adjacent turns is less, and therefore there is less liability to burn out, while the excellent ventilation prevents overheating; also, if any thing happens to one armature, the other can be used to run part of the lamps.

The mechanical construction of the dynamos is excellent, and, from the testimonials contained in the last circular issued by the company, it would seem that the machine can stand the maximum of rough usage with a minimum of repair.

Besides the high-power lamps of 2,000, 1,600, or 1,200 candle-power, the Ball Company advertise smaller arc-lamps of 800 candle-power, for use in stores, etc., and they also provide incandescent lamps to be used on arc-light circuits. They also furnish complete incandescent-light installations.

THE "IDEAL" STEAM-ENGINE.

AN improvement in one of the most important steps in the conversion of heat into power, showing the results of scientific methods applied to the design and construction of the steam-engine, is illustrated on this and the next page. This engine, which is known as the "Ideal," is a more highly developed form of the Ide engine, and is manufactured by A. L. Ide & Son of Sprinfield, Ill. It was designed to meet the special requirements of electric lighting, such as high speed, small space, perfect regulation, absence of vibration, and economy in the use of steam; and the results shown by actual use prove that the designers of the engine are progressing in the right direction. The engine is compact, perfectly balanced, and self-oiling; and, as it has a rigid double frame with heavy sub-base, it may be run at a high speed without vibration.

The manner of lubricating the guides, cross-head pin, and piston-rod, is shown in the longitudinal section, Fig. 1. The oil is taken up by the crank-pin disks, when in motion, and thrown by centrifugal force upon the guides and piston-rod. The oil wiped from the upper guide by the cross-head slide passes through a tube in the top slide, entering a funnel in the connecting-rod, and thoroughly lubricating the cross-head pin. The peculiar manner of keeping a constant supply of oil in contact with the crank-pin, main bearings, and eccentric, is shown at Fig. 2. Some of the oil thrown off by the revolving disks is caught in the pockets in the disk-hood (Fig. 1). The oil from the upper pocket is conducted by a tube provided with a regulating-cock to a receptacle on the eccentric-strap, whence it passes, after lubricating the eccentric, to a drip-pan underneath, and thence back to the oil-well for further use. The oil from the other pocket flows through pipes into pockets cast upon the main bearings. From these points it flows into the grooves and channels connecting with the crank-pin, which is hollow. The centrifugal force carries it into the crank-pin, from which it escapes through holes into the bearing. Thus it will be seen that the main bearings receive constant lubrication, while the crank-pin receives a supply of oil from either side. This method of lubrication is constant, and provides for the most important bearings about the engine. Sufficient oil is placed in the basin under the crank-disks to cause it to flow in streams through both

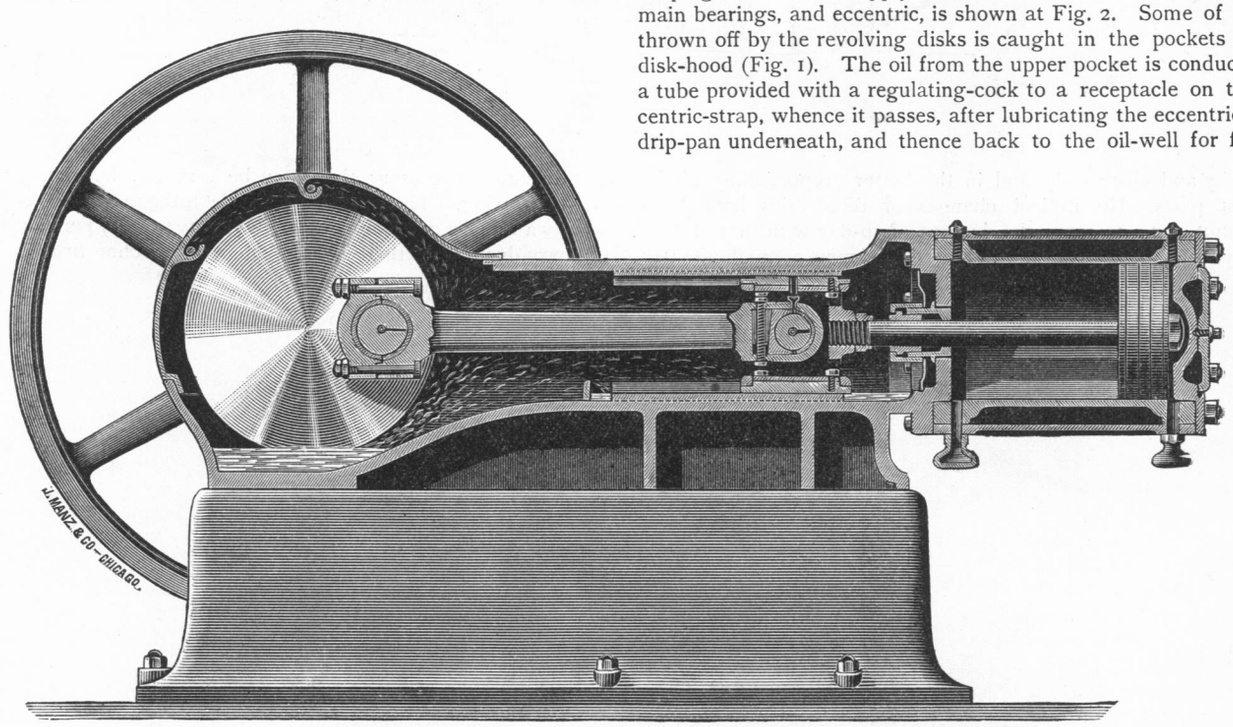


FIG. 1.

pipes and in drops to the eccentric, but valves are provided on the pipes so that the supply can be regulated as desired; and the reservoir can be supplied with fresh oil while the engine is running. Besides the saving in oil, these devices keep a clean and presentable engine and engine-room.

The automatic cut-off governor is shown in Fig. 3. It is an isochronous governor, very simple in construction, and responds instantaneously to the slightest variation in load, cutting off the steam at a point that will just do the work and maintain the fixed speed of the engine. It is secured to the side of the fly-wheel, and connects direct through the eccentric on the main shaft with the valve, without the use of gearing, pulleys, shafts, or belts. All its parts are in sight, and are readily accessible for cleaning. It gives an open port at the beginning of each stroke, admitting steam to the piston at full boiler pressure, and varies the point of cut-off as the load requires, from the beginning to three-fourths of each stroke. The speed of the engine remains practically constant, regardless of the change of load or variation of steam-pressure in the boiler, the variation from no load to the full power of the engine being, it is claimed, less than one per cent. The

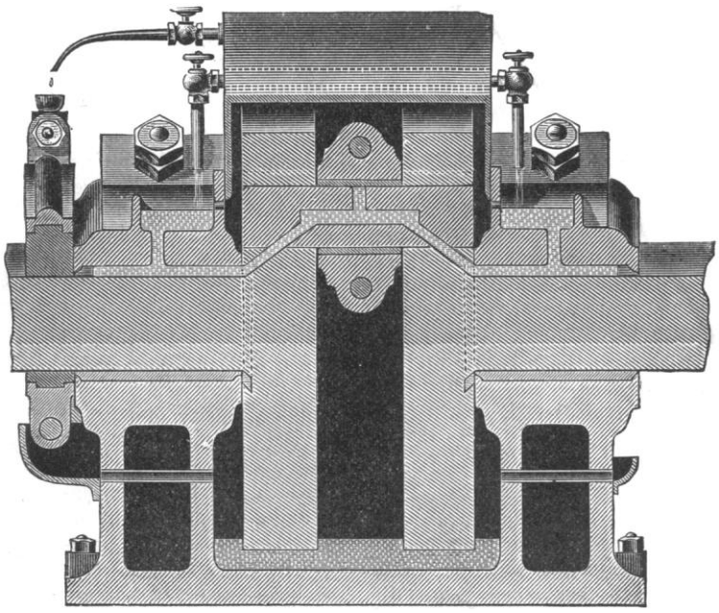


FIG. 2.

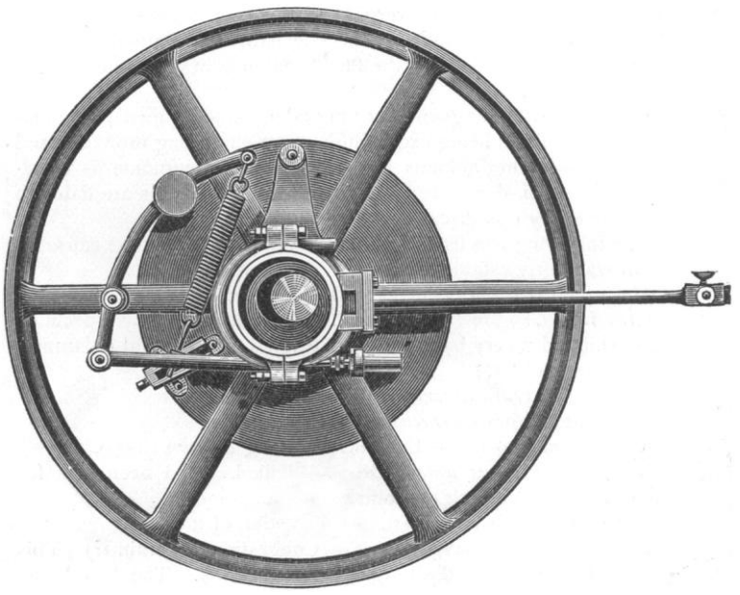


FIG. 3.

dash-pot attached to the eccentric prevents any sudden movement of the weight when a great change of load occurs suddenly. The running speed of the engine may be changed to suit requirements by shifting the position of the weight on the lever.

The steam-chest is bored out and fitted with a pair of cylinders or bushings which have supporting bars across the ports, to prevent any possibility of the valve catching upon the ports. The valve is of the hollow piston type, — a hollow tube, with a piston at each end. It is surrounded by steam, which presses equally upon each end, thus perfectly balancing the valve and relieving its pressure, insuring it long service with little wear. The piston-head is a single casting, hollow, and as light as is consistent with strength. The cross-head is a crucible steel casting, with phosphor-bronze slides; and the attachment to the connecting-rod is central, thus avoiding any strain on the piston-rod by angular thrust. The guides are bored out the same size as the cylinder, thus insuring large wearing surfaces and constant accuracy of line with cylinder. This, together with the self-oiling devices, insures cool running, and long service without adjustment. It may be added, that the construction seems to be such as to give the required strength and rigidity for high speeds; ample wearing surfaces are provided; all the parts are made of steel, phosphor-bronze, and charcoal iron, and are interchangeable; and every engine is tested by actual service at the factory.

SCIENTIFIC NEWS IN WASHINGTON.

Does Exposure to the Sun cause the Human Skull to be Harder and Thicker? — Diseases of Menagerie Animals.— The Geological Survey.

Does Exposure to the Sun cause the Human Skull to be Harder and Thicker?

ONE of the most interesting things mentioned by Professor Virchow in his little book just published, entitled "Medical Remembrances of an Egyptian Journey," in which he describes an excursion up the Nile as far as the first cataract, is that the broken skulls on the first great sepulchral fields, dating from Roman times, are as thick and hard as Herodotus says those of the slain Egyptians were in comparison with the brittle ones of the Persians. The Greek historian explains this by attributing it to the early exposure of children to the heat of the sun; and in many parts of upper Egypt the German travellers actually found young children thus exposed during their parents' absence in the fields, in immense clay bowls, resembling in shape a champagne-glass with a stem, into which they were put without shelter.

This discovery by Professor Virchow is interesting, because it at once suggests the question whether the proverbial thickness of the skull of the negro has not been caused by exposure to the sun, and whether it is a peculiarity of savages of tropical countries that their skulls are thicker and harder than those of the inhabitants of temperate and colder countries.

Students of craniology have never made any investigation to ascertain whether the skulls of different races vary in degrees of hardness. It would be almost impossible to make such an inquiry. As is well known, the human skull increases in hardness from childhood to maturity and age. A miscellaneous collection of skulls of any given people would therefore be of no value in such an investigation. To obtain a collection of skulls of a number of nationalities, that should be taken from subjects all of the same age, to have them all similarly prepared and in sufficient numbers to make it possible to draw any general conclusions from their comparison with each other, would be manifestly impossible.

More attention has been given to the relative thickness of different skulls, or rather to their weight, from which their thickness may be inferred. Of the large collection of crania in the Army Medical Museum at Washington, the thickest are those of negroes and Alaskan Indians. The skulls of other Indians, both of North and South America, in tropical or temperate climes, and of the Eskimo, do not appear to be particularly thick. Among the ancient