able saving in the absence of the tender with its dead weight of water and coal. This would permit more freight to be carried.

The efficiency of any mechanical device is increased by the reduction of the number of its working parts. In the electric motor there are no parts except those in circular motion. When the armature surrounds the axle of the driving wheel, which is the case in electric locomotives, it is possible to get a very great speed without any vibration. In connection with a main line equipped for electric traction, a system of short branch lines could be operated to advantage by means of storage battery cars, which are now found practicable for distances of 30 or 40 miles in Europe with one charging.

It is said that loss in electrical transmission, which now amounts, it is variously estimated, to from thirty to fifty per cent., can be very greatly reduced by the employment of alternating currents, and step-up and step down transformers. The introduction of improvements will undoubtedly extend the use of electricity. In the meantime, great interest will be taken in the Hull-Aylmer line, whose equipment was described in the last issue of THE CANADIAN ENGINEER, as it is the first step in that direction in Canada.

For THE CANADIAN ENGINEER.

DYNAMO CONSTRUCTION.

BY J. B. HALL, B.A. SC., E.E.

A short description and sketches of a two-light dynamo or one-eighth horse-power motor.

The following description, with accompanying sketches, is from calculations carefully worked out, and if exactly followed in construction will produce a machine equal in efficiency, durability and appearance to any dynamo of its capacity on the market. Amateur electricians possessed of the usual workshop equipment can manufacture it with little trouble. As it is not the intention to follow the design of the dynamo from an engineering standpoint, the various considerations leading to the selection of the form of different parts, where choice is allowable, will not be discussed, as a tendency in that direction is to make the article uninteresting to the persons for whom it is intended.

The shaft, *b*, is of machine steel, turned and threaded as shown, 10 inches long, ⅝ inch diameter at bearings and ½ inch diameter at spider, *x*; a hole is drilled in which pin, *r*, is driven, after lock nuts, *z,z*, are threaded on. The spider, *a,a*. and end, *x*, are of cast brass, three armed (arms $\frac{3}{16}$ inches thick) bored ½ inch diameter to fit shaft, and turned to 2 inches diameter, when on shaft, to receive the laminations, *b,b*.

The armature core is composed of sheet iron stampings (termed laminations), Nos. 27 to 34 gauge, three inches diameter outside and two inches diameter inside. The sheets are separated by paper (newspaper will do) of the same shape. They are threaded on the spider, then tightened as much as possible by end *x*, and lock nuts *z, z*; when tight, the core *l*, is two inches long as shown; then the surface of *l* is trued up in lathe with a very sharp diamond point tool to 2⅞ inches, care being taken to prevent burrs from forming across the paper separating laminations. Holes are drilled in ends of core *l*, as shown, *n,n*, to receive small wire nails to divide the winding, the nails being withdrawn when the coils *c, c* are complete. The core is now ready for winding.

Winding.—Insulate the core and spider with ordinary white tape ⅛-inch wide, lapping same; then shellac the whole and permit it to dry. Cut eighteen pieces, each 60 feet long, of No. 24 double cotton covered magnet wire; prepare a long and narrow shuttle of fibre or hard wood small enough to go through the inside of core; wind on it the first length. Form two pieces of wood the shape of the coils, and place them on either side of the coil that is being wound, so as to keep the winding in shape. Fasten the beginning of wire on the shuttle to the left hand nail at *lc* (leaving six inches out) facing commutator end, pass the shuttle through between spider *a* and core *l*, keeping the wire taut so that the layers will mount evenly; repeat the

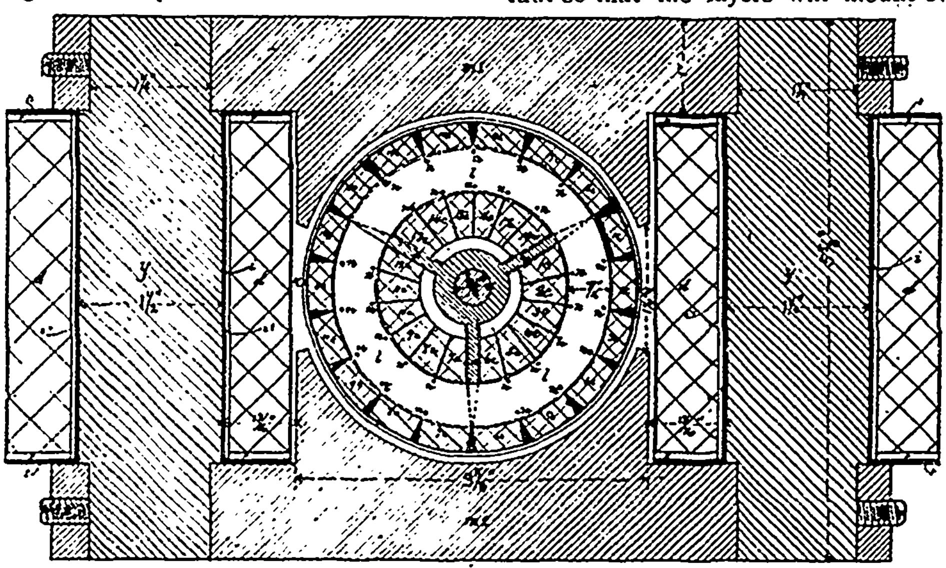

FIG. 1.
LONGITUDINAL SECTION.

process until twenty-three (23) turns are accomplished; the layers inside the ring will need to mount on each other, as there is not room in the space allotted to each coil for the twenty-three turns, side by side; the wire should be evenly wound over the surface. After completing the first layer, wind the second likewise on the top of first back to the beginning, then return over the second layer with the third, and continuing thus until there are six layers of twenty-three turns on the surface, then fasten the end, leaving about 6 inches out. Proceed likewise with the second, third, and so on until the eighteenth coil is finished and the winding closes on itself. After the winding is completed, on the surface is placed a wedge of hard wood, as shown, between each coil to keep them in place; and over all, as shown in Figs. 1 and 2, *w,w*, are wrapped bands of thin mica, half inch wide, on top of which the binding wires are wrapped under tension, and while thus are soldered, to hold them in place. The wire nails, *n,n*, are with-