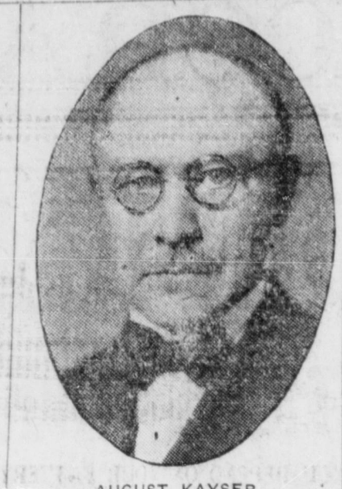
O. B. RINEHART

Chairman Reception Committee



AUGUST KAYSER

Mechanical Display

AN ENGINEERING HISTORY OF SMALL MOTOR AND STAGES IN CONSTRUCTION

MOTOR SHOWN IN FOLLOWING ILLUSTRATIONS WAS FIRST DESIGNED ABOUT 1846—THE MOTOR MADE AT THE LOCAL PLANT IS ONE-FOURTH H. P.

"The powerful magnetic actions which the electric current is capable of producing, have lead to the idea of applying them as a moving power. The figure (1) shows an apparatus which is well adapted to exhibit the manner in which a continuous motion may be produced by the magnetizing action of an (electric) current.

View number 1 of Motor to be made here.

AB is a piece of soft iron, curved into the form of a horse shoe, and fixed to a stand, being encircled by a copper wire. Within A Bis a similar smaller (element) CD, which rotates about a vertical axis. This iron CD is likewise encircled by copper wire in the manner indicated, the two ends of the wire being plunged into a wooden ring-shaped channel filled with mercury. This channel is divided into two parts by means of a wooden or ivory partition. The two partitions must now be filled with mercury to such a height that the level may project beyond the partition walls, although not so as to pass from one space to the other.

The tw oends of the electro magnet CD penetrates sufficiently far into the vessel so as to dip into the mercury on either side of the partition wall, but in such a manner as to admit of their passing freely over it during the rotation of the electro-magnet.

In the position of the electro magnet CD shown above, supposing the plus pole of the (battery) be connected at c and its negative pole at d, the current will pass from c to the left dvision of the channel, from whence it will go through the copper wire round the moving horse shoe from D to C, then into the right division of the channel and from thence to d. In this position the pole C will be attrasted by A and D by B, by which a rotary motion of the electro-magnet CD will be induced. But now when C reaches A and D reaches B, the two ends of the wire of the inner electro-magnet will pass over the partition wall; the current that makes CD magnetic will be interrupted for a moment; as soon however, as the ends of the wires have passed from on division into the other, the current will go in an opposite direction through the copper wire encircling CD, the pole C will then be repelled by A, and D by C whilst C and B and D A will attract each other, thus the rotation of the inner electro-magnet will be continued until C comes to B and D to A.

By continued inversions of the poles of the inner, electro-magnet, the rotation of the latter will be continued."

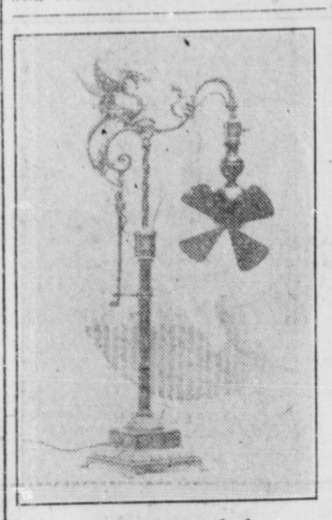
The above is an extract from an old text book edited by Professor Mueller of the University of Freiburg in the year 1848. The figure illustrates and the description explains the working principle of the first form of electrical motor af the wound field type. In principle it is substantially the same as present design of DC motor. This motor was demonstrated about the year of 1846. A glance at the sketch will indicate to the reader that this motor was loaded by means of a weight, a speed reducing gearing being used to increase its ability for lifting. Its work capacity was very meager at best. Since the date of the invention of this form of an electric motor, the apparatus has been developed by aseries of evolutions whereby its status has been changed from that of a mere toy, demonstrating a scientific principle to a practical device utilized in practically every household, where electric current is available.

The first electric motors built varied in sizes from 1 to 5 hp. and were used for miscellaneous applications such as driving jack shafting or individual machines, but the electric fan was the first practical application of the small motor. The first fan motors were of the direct current type, i. e., they operated on a current of undirected voltage, such as is delivered by a storage battery. This motor consisted of two essential elements—the field or stationary part and the motor or rotating part.

The field or stationary element was made up of cast iron having two U shaped protruding arms or poles. Around the yoke between these poles was wound a coil of wire known as the field coil. This coil when excited by an electric current magnetized the magnetic circuit producing the magnetic flux so necessary to the operation of the electric motor. Figure No. 2 shows a motor of this type, used for driving a fan. This motor was built about the year 1893.

View number 2 of Motor to be made here.

The armature or rotor;—the rotating part, consisted of sheet steel laminations stacked on a steel shaft; wound into the slots of these laminations were coils of copper wire, the ends of which terminated in small copper segments. These segments while carefully insulated from each other and other metal parts of the rotor were carefully bound together, forming a ring of copper bars commonly known as a commutator. An electric current conducted into the motor by means of brushes resting in contact with these bars flowed through the windings of the rotor, always in the right direction to properly react with the magnetic flux induced by the field coil, thereby producing motion. This motion was continuous by virtue of the reversals of current in the coils accomplished by the commutator as shown by Fig. (1) above. It will be noted that the ring of copper bars perform the function of the mercury channels used with Professor Mueller's motor.



View number 3 of Motor to be made here.

Sketch (3) shows one of the early forms of direct current fan motors built by the Fort Wayne Works of the General Electric Company, about the year of 1905. The reader will note the ornate character of the design of this motor and its pedestal. Electric fans were at that time a luxury rather than a necessity and considerable attention was then paid

(Continued on page 7, section 1).