of the synchronous motor. Since the resultant ampere turns X is the vectorial sum of the field and armature ampere turns, the field ampere turns are obtained by subtracting vectorially X_a from X, this gives X_f, the field excitation necessary for the motor to operate under the assumed conditions. The above diagram for any load on the motor gives us the value of field excitation required for the assumed value of power factor. The various values of power factor may be assumed and diagrams constructed, and the results plotted into a curve between field excitation and total current, or field excitation and power factor.

Figure No. 1 shows the diagram for a lagging current, and it will be noticed that the reactance voltage is in such a phase position as to subtract from the generator voltage, resulting in a

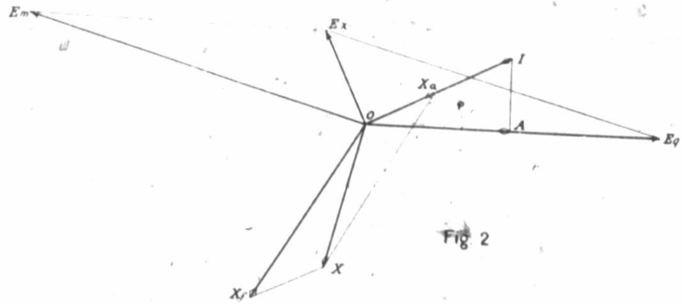

Fig. 2

smaller value of the necessary counter E.M.F. The armature reaction X_a is in such a position that, when subtracted from the resultant ampere turns X, the field ampere turns are smaller than the resultant ampere turns. It may, therefore, be stated as a general principle that with a lagging current on the synchronous motor the effect of the armature reaction is to strengthen the field, and in that way decrease the necessary field excitation.

Figure No. 2 shows the synchronous motor operating with the leading current, and it will be noted that the conditions are just the reverse of those shown in Figure No. 1. Here the reactance volts E_x adds to the generator volts E_g, producing a larger value of counter E.M.F. E_m, while the armature reaction, when subtracted from the resultant field, leaves an impressed field ampere turns greater than the required resultant field. It may, therefore, be stated as a general principle that when a synchronous motor is operated on leading current, the armature reaction tends to weaken