The equivalent circuit can be redrawn as in Figure 17-4 (b). The impedance Z_d is drawn as a capacitive impedance, because that is what is in the important case of a capacitor motor. The current in this impedance is

$$I_{mf} - I_{mb} = - jaI_a \quad \text{.... (17-30)}$$

Equations 17-27 and 17-28 and the equivalent circuit of Figure 17-4 are applicable to a wide variety of induction-motor types. For example, if the stator-circuit impedances are equal when referred to the same winding then $Z_d = 0$ and the forward and backward fields are independent of one another; this special case is exactly like that of the symmetrical motor. If $Z_d = 0$ and if the referred voltages form a balanced 2-phase system of positive sequence, then Figure 17-4 (b) reduces to the equivalent for balanced operation. If winding a is open, then Z_d is an open circuit ; this is the special case of single-phase operation. For this special case $I_a = 0$, and Equations 17-11 and 17-12 become

$$I_{mf} = I_{mb} = \tfrac{1}{2} I_m$$

The equivalent circuit then reduces to V_m applied to the combination of $2Z_{1m}$ in series with the forward-and backward-field impedances. Division of the impedances by 2 gives the equivalent circuit of Figure 17-5.

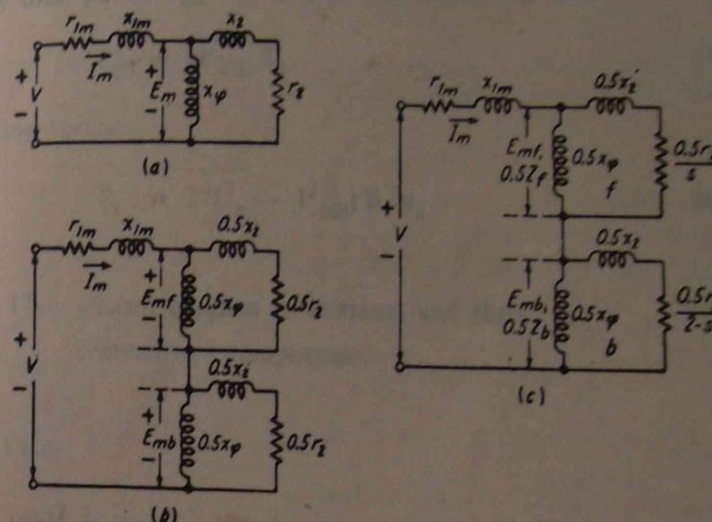

Fig. 17-5.

Figure 17-5. Equivalent circuits for a single-phase induction motor.

Equations 17-27 and 17-28 can be solved for the currents, giving

$$I_{mf} = \frac{V_{mf}(Z_o + Z_b) + V_{mb} Z_d}{(Z_o + Z_f)(Z_o + Z_b) - Z_d^2} \quad \text{.... (17-31)}$$

$$I_{mb} = \frac{V_{mb}(Z_o + Z_f) + V_{mf} Z_d}{(Z_o + Z_f)(Z_o + Z_b) - Z_d^2} \quad \text{.... (17-32)}$$

The power delivered to the forward field by phase m of the stator is $I^2_{mf} R_f$, and since the internal behaviour of the motor for the forward-field components is the same as that of a balanced 2-phase motor, the total power P_{gf} delivered to the forward field by both phases of the stator therefore is

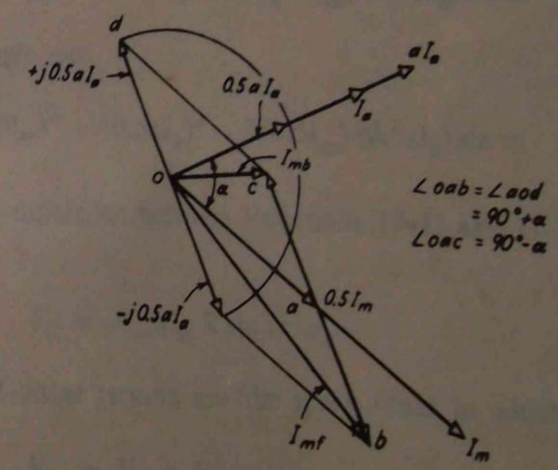

Fig. 17-6.