$$P_{gf} - P_{gb} = I_{1m}^2 (R_f/2 - R_b/2) = 6.13^2 (22.3 - 0.91) = 805 \text{ W}$$

$$T = (P_{gf} - P_{gb})/w_s = 805/157 = 5.13 \text{ n-m}$$

**Example 17-2**

A single-phase 230 V 4-pole 50-Hz 0.5-kW induction motor gave the following test results:

| | | | |
|---|---|---|---|
| Blocked rotor test | 60 V | 1.5 A | power factor, 0.6 lagging |
| No load test | 230 V | 0.535 A | power factor, 0.174 lagging |

Determine the approximate equivalent circuit of the machine. Assume that the stator and rotor $I^2R$ losses at standstill are equal, and that the rotor leakage reactance referred to the stator and the stator leakage reactance are equal.

For the blocked-rotor test, $s_f = 1$. The referred value of rotor impedance, $R'_r + jX'_r$, will be much smaller than the magnetizing impedance, $R_0 + jX_0$; therefore, to a good approximation the equivalent circuit for $s = 1$ is as shown in Figure 17-6 (a).

Input impedance with the rotor blocked, $Z_{sc} = R_s + R'_r + j(X_s + X'_r)$

$$= 60\,\underline{|0^\circ} \,/\, 1.5\,\underline{|-\cos^{-1}0.6}$$

$$= 24 + j\,32 \text{ ohms}$$

$R_s + R'_r = 24$ ohms so that $R_s = R'_r = 12$ ohms

$X_s + X'_r = 32$ ohms so that $X_s = X'_r = 16$ ohms

For no-load conditions $S_f = 0$, in which case the magnetizing impedance, $R_0/2 + jX_0/2$, will be much smaller than $R'_r/2s_f + jX'_r/2$, which tends to infinity when $s_f = 0$. On the other hand, $R'_r/2(2-s_f) + jX'_r/2$, which tends to $R'_r/4 + jX'_r/2$ when $s_f = 0$, will be much smaller than $R_0/2 + jX_0/2$. A good approximation for the equivalent circuit of the single-phase machine on no-load is therefore as shown in Figure 17-6 (b).

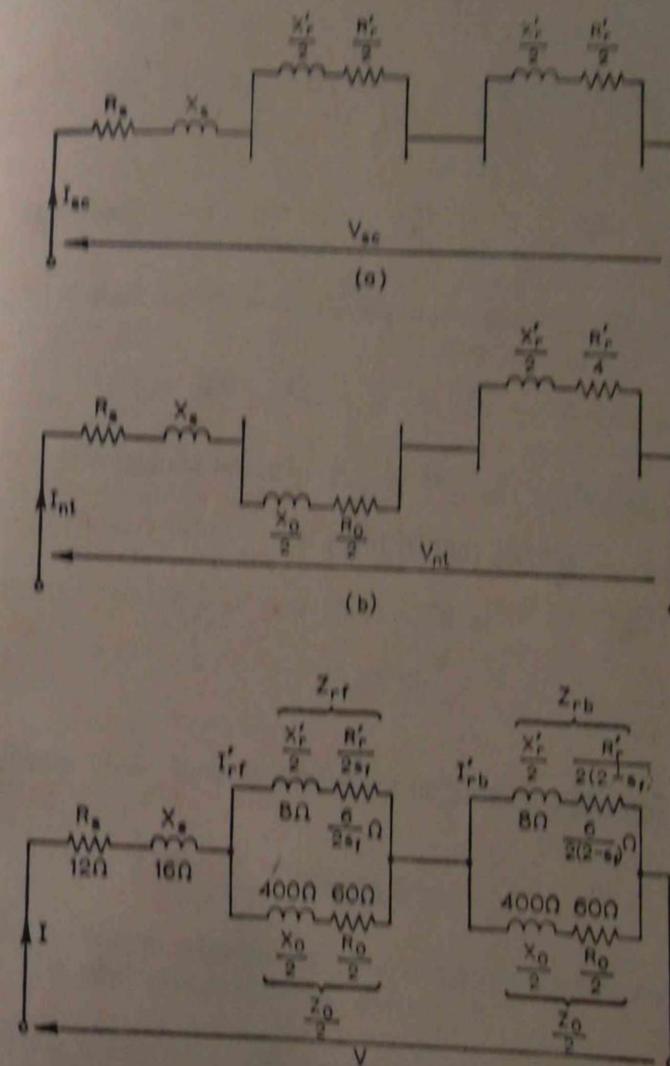


**Fig. 17-7.**