3rd. Independent feeder regulators for all polyphase as well as single phase feeders.

(b) For small stations. Either polyphase generators with single phase feeders, which may be thrown by the proper switchboard devices to either phase of the generator, and each feeder provided with independent pressure regulator; or single phase generators, with single phase feeders, each feeder being operated with independent pressure regulator.



Curves showing excess of transformer losses for multiphase motors as compared with single phase.

This policy with respect to station and distribution equipment is advocated on the conviction that the single phase motor has come to stay, and that it affords an alternating current central station-polyphase or single phase-the ideal means of distributing small power. There may be a difference of opinion between the writer and central station engineers as to the scope of the term "small power," but in the writer's belief it is a generally conceded fact that the single phase motor is the central station man's best instrument to economical power service up to units of a certain magnitude. The writer believes single phase motors should receive preference of the operating engineer of multiphase stations, up to units of at least 15-h.p. capacity, and, in selected instances, up to units of even 35-h.p. capacity. The limit of size is fixed naturally by the unbalancing effect produced between phases of the polyphase system. Polyphase stations of the writer's knowledge are successfully operating single phase motors of 35-h.p. Single phase stations with individual generators not exceeding 75 K.W. capacity, are also successfully operatwith single phase motors of 30-h.p. each. ing The justification for the use of single phase motors by polyphase plants arises from the lower first cost of individual power installations, and also the higher efficiency in small units of these installations. As illustrating the high first cost in step-down transformers alone, for polyphase motors, as compared with single phase motors, your attention is called to Fig I, and as illustrating the high core losses of step-down transformers for polyphase motors, as compared with single phase motors, your attention is called to Fig. 2.

The curves in these two figures are plotted on the basis of standard sizes of step-down transformers now prevailing, and the sizes of transformers required under the various conditions of service are those shown in the following table:

Transformers Required.

Single	2-Phase	3-Phase	3-Phase
Phase	2-Trans.	2-Trans.	3-Trans.
I-I KW	2-6 KW	2-6 KW	3-6 KW
I-2 "	2-I "	2-1.5 "	3-1 "
1-3 "	2-1.5 "	2-2 "	3-1 "
1-4 "	2-2 "	2-2.5 "	3-1.5 "
1-5 "	2-2.5 "	2-3 "	3-2 "
1-7.5 "	2-4 "	2-4 "	3-2.5 "
I-IO "	2-5 "	2-5 "	3-4 "
I-15 "	2-7.5 "	2-10 "	3-5 "
I-20 "	2-10 "	2-15 "	3-7.5 "
1-25 "	2-15 "	2-15 "	3-10 "
I-30 "	2-15 "	2-20 "	3-10 "
I-40 "	2-20 "	2-25 "	3-15 "
	Single Phase I-I KW I-2 " I-3 " I-4 " I-5 " I-7.5 " I-10 " I-15 " I-20 " I-25 " I-20 " I-25 " I-30 " I-40 "	Single 2-Phase Phase 2-Trans. I-I KW 2-6 I-2 " 2-1 I-3 " 2-1.5 I-4 " 2-2 I-5 " 2-2.5 I-7.5 " 2-4 I-10 " 2-5 I-15 " 2-7.5 I-20 " 2-10 I-25 " 2-15 I-30 " 2-15 I-30 " 2-15 I-40 " 2-20	Single2-Phase3-PhasePhase2-Trans.2-Trans.1-1KW2-6 KW2-6 KW1-22-1.52-1.51-32-1.52-2.51-42-22-2.51-52-2.52-31-7.52-42-41-102-52-51-152-7.52-101-202-152-151-302-152-201-402-202-25

When the increased cost of polyphase line construction is taken into consideration, there becomes quite evident a material advantage for the single phase motor, even though the first cause of the motor, as compared with a polyphase motor of the same size, may be somewhat in excess of the polyphase motor. There is a rapidly developing tendency toward the installation of single phase motors, on polyphase stations, and as the possibilities of the single phase motor as to-day built, are becoming better understood, it is the writer's opinion the use of single phase motors will grow with even greater rapidity. An instance recently occurred in which the contracting department of a large company agreed to supply polyphase current for 50 1/2-h.p. polyphase motors to be located in retail stores at isolated points on the distribution system. Each motor required an equipment of two step-down transformers. Upon installing the first motor, it was found the idle transformer losses exceed the effective load on the motor, and it is needless to say the operating department declined to carry out the contract made by the contracting department, and insisted upon the substitution of single phase for the polyphase motors. Great development has been made in the application of single phase motors by using non-inductive starting boxes for holding down the starting current. These boxes conform in general character to the usual direct current motor controlling rheostats. By their use motors of larger capacity may be used judiciously without injurious unbalancing effects on polyphase systems. The single phase motor built by the Wagner Electric Mfg. Co. possesses a starting torque characteristic when starting rheostat is not used, as illustrated in the broken curve in Fig 3. Instances are exceedingly rare where torque of this great magnitude is necessary to successfully start the load. Therefore, a starting rheostat may be used and starting current held down to a low limit without sacrificing the necessary starting torque required for the usual installation. Fig. 3 illustrates a test made by one large company, in which full load torque was maintained from rest to full speed, without the current exceeding at any time the full load current. This is a better result than will be developed by the average motor, the manufacturers of the Wagner motor not claiming to be able to start full load torque in much less than 125 per cent. of full load current.



It is not necessary to dwell at any length upon the desirability of actively canvassing for motor load. Canadian stations are perhaps in advance of the average American companies in having for a number of years endeavored with great activity to secure a large load factor. The writer therefore believes that the operating engineer attending this convention will, without entering into the discussion in greater detail, accept this statement—that the single phase motor affords an exceedingly useful adjunct to the development of larger station earnings, by not only taking care of one form of business, which it has hitherto been difficult to take on, namely, the isolated power customer—but also by enabling the handling of a larger power business, even in the concentrated business districts at a lower first cost of installa-