FOR many years reciprocating compressors have been driven by direct-connected low-speed electric motors, and specifications for these motors have been set up by the electrical industry for this application. More recently however, geared turbines have also been used where the heat balance of a plant indicates their suitability, where emergency stand-by power is required in case of electrical failure, and of course where electrical power is not available.

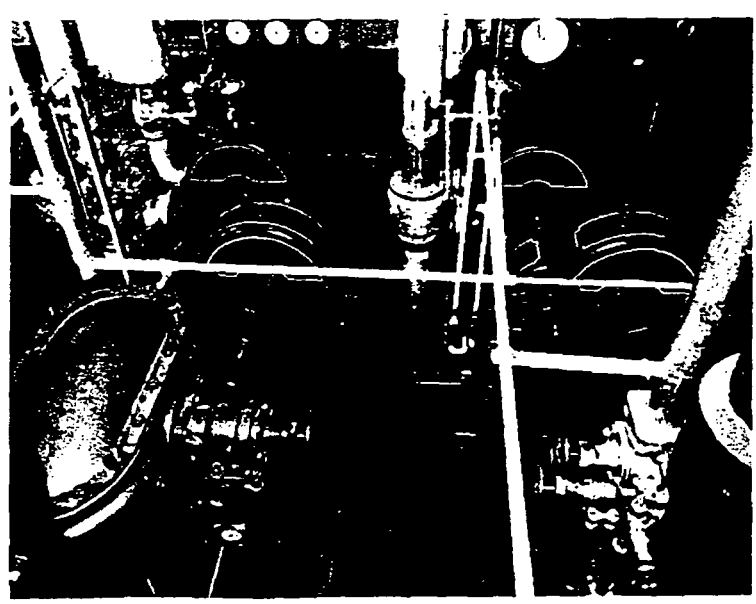
The basic principle of the reciprocating compressor, whether it be single- or multiple-cylinder, single- or double-acting, results in variations of power input during each revolution of the compressor shaft. With the use of either geared turbine or motor drives, there is the problem of limiting this load variation to an acceptable range.

In the case of the motor drive, this load variation does not hurt any of the motor's mechanical parts, but does produce a wide fluctuation of current input to the motor. On the other hand, with a geared turbine drive, it is the high-speed reduction gears that must be protected. These gears, which reduce a turbine speed of about 3600 rpm down to a compressor speed of perhaps 300 rpm, are manufactured with a certain amount of backlash, and when the torque is not steady the pressure at the tooth contact point will vary, and with severe torque variations there may be a loss in contact between the teeth. This places a heavy impact load on the gear teeth, and they may wear rapidly due to the failure of the oil film, or under some conditions, actually break. Furthermore, a very loud and objectionable noise is set up.

Torque variations are a function of rotating inertia of the parts of the system and by changing the inertia and flexibility of the system, these variations can be controlled. Corrective measures taken to smooth out the torque variations include installing a separate flywheel on the compressor shaft, installing a soft coupling between drive and compressor shaft, and in the case of a motor drive, increasing the flywheel effect of the motor rotor. For a motor-driven compressor, a compressor manufacturer can specify the flywheel effect needed in the motor rotor. However, with a geared turbine it is essential that a complete torsional analysis be made of the system to determine what corrective step should be taken for smooth operation.

Since detailed information on the compressor is required and also since corrective measures must be taken on the low-speed coupling normally furnished by the compressor manufacturer and on the flywheel which is also part of the compressor, it is standard practice for the compressor manufacturer to make the torsional analysis of the system and determine the correct design of the various parts. It is difficult and expensive to alter the design of the turbine and gear, but this could be accomplished by the use of larger, heavier gears, or quill shafts in the gear.

Elliott Company has worked closely with compressor manufacturers in solving the problems presented by geared turbine driven reciprocating compressors and now has several very successful installations. Three of these are shown on these pages.



At the Falstaff Brewing Corporation's New Orleans plant, two new Vilter 360-rpm vertical reciprocating twin-cylinder ammonia compressors were installed, each driven by an Elliott 160-hp, 3240-rpm turbine through an Elliott 9-to-1 gear reduction unit. The flywheel, mounted on the compressor shaft, compensates for the load variation during cylinder strokes. (A more complete writeup of the installation appears in the Summer 1954 issue of Powerfax.)