

Co. The intercooler of this compressor is the arched pipe extending across from one cylinder to the other. This contains a large number of small tubes through which cold water flows.

Fig. 9 shows another odd English design. It is manufactured by the firm of S. H. Johnson & Co. It will be seen that it consists of a tandem compound steam engine driving a tandem compound compressor, but it differs from Fig. 20 in having the power transmitted through a crank shaft.

Fig. 30 shows the general design of the Norwalk straight-line three-stage compressor. The dotted lines show the direction of air circulation through the machine. The intercoolers C_1 and C_2 , are simply diagrammatic, the actual intercoolers being on the top of the machine and extending nearly the whole length of it. It will be seen that the low pressure cylinder L A is double-acting, but that the intermediate cylinder I A, and the high pressure cylinder H A, are single-acting and compress on alternate strokes. This arrangement is open to somewhat the same objection as the single-acting tandem compound arrangement, shown in Fig. 24; that is to say, the resistance and the work of alternate strokes are not equal. In this case, though, owing to the low-pressure cylinder L A being double-acting, the proportional inequality will not be nearly so great, and is hardly worth considering when compared with the advantages of simplicity of construction, good cooling and ease of packing, secured by the single-acting arrangement. The Norwalk Co. kindly sent blue-prints and other matter relating to this compressor, from which the following description is compiled.

The steam cylinder S is 16 inches in diameter. The double-acting intake cylinder L A is $10\frac{1}{2}$ inches in diameter, the single-acting intermediate air cylinder I A is $6\frac{1}{4}$ inches in diameter, and the single-acting high-pressure cylinder H A is $2\frac{5}{8}$ inches in diameter. The common stroke is 16 inches. The clearance of L A is 3%, of I A it is 3.1%, and of H A it is 2.5%. This includes indicator pipes and rigging, which, in the case of the high-pressure cylinder, formed a considerable portion of the clearance. Blue prints of indicator cards show that the final gauge pressures were :

Low pressure air cylinder L A	72 pounds per square inch.
Intermediate air cylinder I A	410 " "
High pressure air cylinder H A	2,030 " "

Diagrams are given of the "Combined unbalanced pressures on the three air pistons, referred to the $10\frac{1}{2}$ inch air piston." These