AN ECONOMICAL AIR COMPRESSOR[1]

DOUBTLESS in many laboratories the need has been felt for a practical and economical type of air compressor, and perhaps the idea of converting a car motor into one has occurred to many. Such an apparatus has found sufficient application in our laboratory in operating the air turbine ultracentrifuge[2] to warrant a description of it here.

Briefly, the compressor consists of a second-hand model T Ford motor (other types of car motors would probably do equally well) in which the following modifications were made. In order to increase the compression ratio and thus increase the efficiency of the motor as an air compressor, it was necessary to partially fill the combustion chambers of the head with babbit metal. However, before doing this we inserted a completely threaded pipe six inches long into each of the spark plug holes so that when the head was assembled there would be a space of about one half inch between the level of the pipe and the level of the piston when the latter was in its uppermost position. A metal pin inserted through a small hole bored near the end of the pipe extending into each of the combustion chambers was found to aid considerably in anchoring the babbit metal in position.

The head was placed in a level position with the combustion chambers up. Melted babbit metal was then poured into each of the combustion chambers to the level of the end of the protruding pipe. This filled the combustion chambers of the head so that when it was assembled there was only about one-half inch space between the babbit on one side and the pistons on the other when the latter are in their uppermost position. (Perhaps a flat metal plate machined so that there is just sufficient space in the head to allow the air to enter and escape would be an improvement.) After the head is assembled four check valves with the gate valve opening upward were screwed on to the four short pipes extending out of the spark plug holes. (We used Jenkins one-half inch air check valves; ordinary water check valves are not satisfactory for this purpose.) It is desirable for greater efficiency of the compressor to place the check valves as close to the head as possible. The check valves are then connected by pipes to a storage tank tested to the maximum pressure desired.

The ends of the exhaust valves are cut off so that they do not contact the rotating cam shaft, thus permitting them to remain closed at all times. The ends of the intake valves are likewise cut off so that they, too, do not contact the cam shaft. The intake valve springs are weakened by cutting off the ends until only a slight tension exists when the valves are completely closed. Thus, when the machine is operating the intake valves work automatically, opening on the down stroke and closing on the upstroke of the pistons.

The compressor was then mounted on a suitable frame and an eleven-inch pulley attached to the crankshaft. We have used a five horse power electric motor with a six-inch pulley to drive the compressor, but if such were not available a second-hand car motor would perhaps do equally well. Because of the heat generated by the compressing of the air, it is advisable to retain the original water cooling system of the motor or, perhaps more conveniently, to attach the circulatory system of the compressor to the water tap. Oil is placed in the crank case to the proper level.

With the air compressor just described we were able to obtain 100 pounds pressure in a 30 gallon tank within one minute and maintain a constant pressure of 80 to 90 pounds while operating the air turbine ultracentrifuge, which has an escape at this pressure of approximately 12 cubic feet of air per minute. More or less pressure may be obtained by increasing or decreasing the speed of the compressor.

A number of variations for this type of air compressor made out of a converted car motor are no doubt possible. In fact, it seems feasible that certain of the cylinders might be modified to compress air, while the remaining ones are used as the driving motor. However, we have not attempted to construct such an apparatus.

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[2] J. W. Beams, A. J. Weed and E. G. Pickels, SCIENCE, 78: 338, 1933.

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