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PNEUMATIC POWER IN WORKSHOPS *

BY JOHN DAVIS BARNETT, M. CAN. SOC. C.E., STRATFORD.

In the early days of ironworking the tools were usually brought to the work, and they were manual. Later, as tools increased in size and stiffness, the work was brought to the machine and moved with it under or against the tool. To-day, in many operations, the bulk of metal to be handled is getting so unwieldy that it is again proving common practice to carry the machine tool to the work. Electrical and air motors are certainly factors in this evolution, even if not largely responsible for it. This paper proposes putting on record the present position of air power, as part of a craft, illustrated more especially by railway shop-work.

A natural hope, then, would be that the author should give figures, comparative between air-driven, water-driven, electrically-driven and shaft-driven machines.† Such figures the author cannot give from his own experiments, and after wide search is of the opinion that at the present day they have not been obtained; therefore, this paper must be qualitative rather than quantitative.

The author does not intend to say that air, for continuous work in plate flanging, or for high pressures in stamping and forging, is a more economical transmitter of power than water, or that pipes, air engines and motors are better or cheaper than wires and electric motors, or independent air-driven tools than steam applied through shafting and belts to a compact group of machine tools, but he is of the opinion that if many widely scattered, different and intermediate operations are to be performed; if a cold climate has to be fought; if the technical skill and knowledge of the workman employed is limited; and if the special and portable tools are more or less of home design and manufacture to suit the particular and limiting conditions of their use, then air has efficiency, economy and a wide field of usefulness. For the many and varied services it now is used in and about a railway, see the appendix. The common opinion that the compressing of air was costly and power transmission by it wasteful, has been the main obstacle to its more extended use. Prof. J. T. Nicolson, M.C.S.C.E., has (in Transactions, v. 7, p. 79) clearly proved that there is no difficulty or great first cost in securing a mechanical efficiency of 86 per cent., a thermodynamic of 92, and a main (pipe) efficiency of 96.2; and re-warming the air near to the motor, that he recommends, the author finds in practice to be easy, cheap, and so effective as to tempt him to emphasize Prof. Unwin, who says (Proceedings I.C.E., v. 105, p. 202) heat applied in re-warming compressed air is used nearly five times as efficiently as an equal amount of heat employed in generating steam.

The data and recorded experience in compressors and compressing are enormous, and do not require our attention, except to note that for delivering small volumes of air a staple article of machinery supply on the market to-day is belted-compressors, worked from the shop shafting, having single acting pistons, compound pump chambers, and intermediate air cooler, doing the compressing in two or more stages. They are automatic in action, that is, when the receiving reservoir is above normal pressure the driving belt is moved across from the fast to the loose pulley (both on the crank shaft) by means of a small air cylinder, whose piston rod is coupled direct to the belt shifter; the admission of the compressed air to this small shifting cylinder being controlled by the movement of a diaphragm, whose under side is open to the receiver pressure, and whose lift is controlled by an ordinary safety valve lever, carrying a sliding balance weight, adjustable at will. If the demand be very irregular as to amount, several such belted compressors have been used coupled up in automatic series. Also, pressure from the receiver has been used to throw a friction clutch in and out of gear, and thus secure the intermittent action of a belted compressor. For compressors generally it may be said that it is advisable, where possible, to use large units, run at fairly moderate speeds; to take the air in as free from dust as possible—the author takes it from under the external eave-trough—also to take in the coldest air possible, as for each 5° lower temperature of the entering air there is said to be a one per cent. increased efficiency in the compressor.

The shop piping or main for ordinary pressures (80 to 100 lbs.), should not be less than 1½-inch diameter, the larger the better. The author having four inch pipe spare on hand, used it with great satisfaction, as it gave ample power storage and little friction. Very slight provision is required for drainage. The main is best carried on the top of the roof tie beam, and

*A paper read before the Can. Society of Civil Engineers at the summer Convention, Toronto, June 18th.

†For such an economical comparison between small motors see Proceedings I.C.E., vol. 105, p. 308.