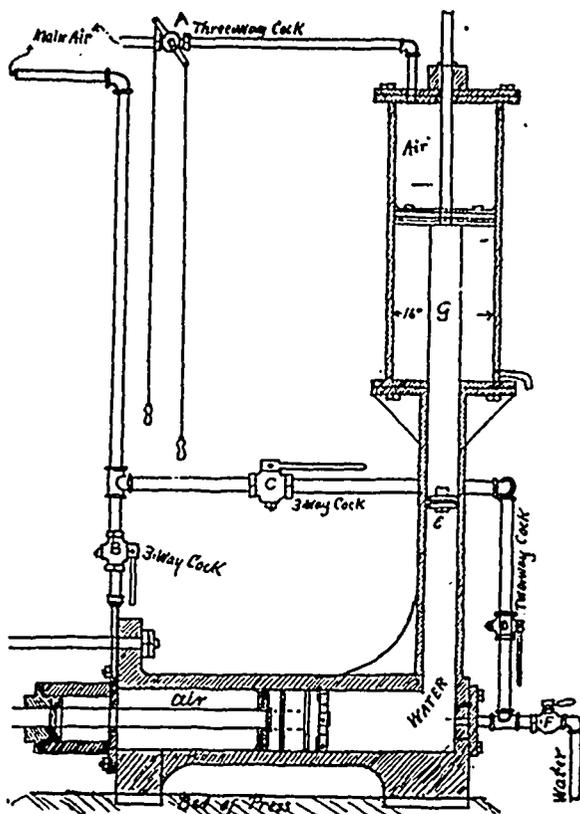


ment in the boring and planing of large cylinders, pump barrels, etc., that both these operations be done on the one machine table without resetting the work, and this has of late been done by M. C. Bullock Co. of Chicago,* the one operation following the other, but with a suitable air motor and flexible hose it should not be difficult to do both operations at once, although the author is



not familiar with any portable air motor on the market powerful enough to do the boring in as short a time as the planing usually occupies. It is also possible to do the milling out of the steamports by a second air motor while the boring is being finished, the whole needing but one attendant, as when on piecework one man regularly attends to three milling machines.

To summarize, air is in practice proving to be a fairly cheap and most convenient transmitter of power, allowing fine subdivision and transportation to remote points, with the crowning and unique quality of suffering no appreciable loss when held in storage. For intermittent service it is of great value, allowing widely varying speed of tools, dispensing with long lines of shafting and belts, giving free head room, and increasing the shop light as well as lessening the first cost of roof frames when they have not to carry shafting. The pipes require no coating; they radiate no heat, and therefore can be put in close corners without increasing the fire risk; their direction is readily changed in any plane without risk of pocketing or water-hammer, and leaky joints (we all get them) are not a nuisance or a risk. In no case are exhaust pipes required, and in most if not all cases the exhaust adds to the men's comfort.

APPENDIX.

LIST OF PNEUMATIC TOOLS AND MACHINES AT THE TOPEKA WORKSHOPS OF THE A. T. AND S. F. RY.

One riveting machine of 10 ft. reach, with pneumatic crane, 1 riveting machine of 6 ft. reach with frame, 1 combination flange punch and riveter, 2 truck riveters, 1 bridge riveter, 1 frame riveter, 1 tank riveter, 1 mud-ring riveter, 1 staybolt breaker, 1 staybolt cutter (nip-

per), 20 rotary motors, 4 brotherhood engines, 1 grinder, 1 saw, 6 hammers (hand), 1 punch, 1 angle-iron shears, 1 bolt machine, 3 hammers in smithy, 1 large punch and shears, 1 bulldozer, 1 rail saw, 1 rail drill, 2 rail benders, 1 stamping machine for tin shop, 1 bolt shearer, 1 port miller, 3 letter presses, 6 pulling down jacks, 12 car jacks, 2 drawbar jacks, 3 painting machines, 1 washer maker, 3 rivet holders, 2 tube rollers, 8 pumps, 1 transfer table, 1 driving wheel revolver used in setting slide valves, 30 hoists in shop, 3 hoists 10 feet lift outside, 1 device for handling oil, 1 hose coupling fitter, 1 tool for tearing down old car roofs, 1 drop pit, 1 device for delivering sand, 1 device for extracting oil from waste, etc., 1 shunting locomotive (traction engine), 1 device for securing sheets at flange fire, 1 device for cleaning coach cushions, 3 paint burners, 1 whitewashing machine, 1 device for handling work in brass foundry, 1 turntable revolver.

Air is also used for testing brakes in shop and yard, cleaning boiler flues, cleaning the shops and engines, and in self-moving dead locomotives from erecting to paint shop. Although this makes a good show for one set of shops, it is far from marking the limit of compressed air as applied in railway service to-day. It is used for moving crossing gates; track interlocked derailleurs; single semaphores and semaphores interlocked with switches and gates, and this, too, at points 18 miles away from the compressing plant; in timber preserving by injection; in moving capstans and winches for hauling and shunting purposes; in coaling locomotive tenders; in lifting their ashes out; in sifting, lifting and delivering sand to locomotives; in delivering sand to rail; actuating whistle signal; moving the rocking firegrate; opening the firehole door; ringing the bell, and perhaps the best known of all, in actuating the continuous automatic brake. Also on other rolling stock for controlling snow-plow wings and aprons; ice flanges and scrapers; doors of dump and drop-bottom cars, and for tilting ballast cars; and inside shops for bending pipes; cleaning pipes from internal scale; testing pipes and their jointing; with gas jets for heating tires and other rings of metal; as a blow pipe for straightening bent wrought iron frames; for spraying fuel into oil furnaces; for belt shifting on counter shafts; for machine brakes to stop tools at a definite point: for supplementing the wheel and axle hydraulic press; for axle box and journal press; with sand as sandblast for cutting and scouring; and for scrap shears and scrap tumblers at far end of yard where the noise is least annoying, and where there is ample space for scrap sorting.

DISCUSSION BY THE C.S.C.E. OF PNEUMATIC POWER APPLIED TO WORKSHOPS.

After the reading of this paper the following discussion took place:—

The Chairman: You have before you this morning a paper of immense practical value from one who is a practical engineer and who has for several years had practical experience of air machines. The subject is dealt with in very plain and simple language, and which lays before each one of us the great advantage of air as one of the powers to be applied to manufacturing purposes.

Mr. Barnett mentioned that one of the items named in the appendix is that air is used for whitewashing. Now, that may seem a very small business to bring before a body of learned men. Nevertheless, the whitewashing of a large shop 120 feet wide and 300 or 400 feet long, the point of its roof being 90 feet above the floor level, is an awkward and expensive job when done by hand under the old arrangement. The operation with compressed air is very simple. The whitewash is made and run through a very fine sieve, three or four pounds of tallow being put with each barrel of whitewash, making a sort of emulsion. This is put into