In transmitting motion from an independent engine on shop floor to the drill or tap, an endless cord ¾ inch or ⅞ inch diameter has been used, with light weight grooved pullies, the whole kept in tension by counterweights. This gear proved to be a nuisance because of the amount of tackle and number of pulleys required to change direction of motion. The "Stowe flexible shaft" has also been used. Even this requires a universal coupling joint at one end to meet many conditions of shop service, lengthening it from 8 feet to 8½ feet, the total weight for a No. 8 size being 65 lbs. Its life is short, the repairs excessive, the power it will transmit is small, and to do it the speed of revolution must be high; thus the head for drill or tap must be geared down and therefore made larger and heavier than is required when shaft and tool are revolving at the same speed. A shaft more certain in action, quite as portable, and having longer life, is made by using a steel rod 1 inch diameter, sliding freely inside an iron pipe 1$\frac{5}{16}$ inches outside diameter, with a universal coupling at each end. A shallow groove the whole length of the shaft and narrow feathers on the inside of the pipe insure that both revolve together; the weight of the whole is 35 lbs., and it is usually sustained by a central cord counterweighted. The ordinary length is 7½ feet, extensible to 12 feet, but by using standard gas pipe thread for all connections, duplicate parts can at any time, if required, be added, increasing the length. It effectively transmits from 200 to 300 revolutions per minute with either or both short ends set at an angle of 35° with the central length. For the convenience of the workman the portable tapping head is a light frame, with two and even three handles, carrying a pair of bevel-toothed wheels changing the plane of rotation, and permitting the man to guide or to put personal pressure on directly behind the tap, while its spindle is receiving motion from the side. The speed is such that a tap of 11 threads per inch with rhymering end to it, in all about 18 inches long, is screwed through both steel plates forming the water space inclosing a locomotive fire-box, in from 50 to 60 seconds. The drill press is of course somewhat stouter, having to carry the feed pressure screw.

The standard shape of pneumatic hand hammer (of any American patent) suggests an overgrown pistol, weighing from 8 to 9 lbs. In the smaller sizes the contained piston has a stroke of 2 or 2¼ inches, and strikes directly on the end of the cutting chisel or other independent tool, which moves freely in a socket at the centre of the outer end of the pistol. This loose tool, of ¾ octagon bar steel 6 or 7 inches long, is at outer end shaped to suit its special work, as riveting, nailing, chipping, caulking, beading, engraving, chasing, stonecutting or planishing. Quite recently an improvement has been made in this all-round useful instrument by increasing its piston stroke to 4 inches, and putting the pistol in a tubular case of cast iron weighing 80 lbs. or more. Its mass absorbs most of the reaction blow which the workman found so distressing to nerve and muscle, but as it requires to be suspended and counterweighed, it is necessarily not as portable, and cannot be used under conditions as confined and awkward as the hammer of shorter stroke and lighter weight. The hose is ⅜ inch diameter, and the pressure used from 20 to 100 lbs. As the latter hammer delivers 2,000 or more blows per minute, using of free air per minute 15 cubic feet at 60 lbs., 18 cubic feet at 75 lbs., and 21 cubic feet at 90 lbs., it readily does the work of three men; four is claimed and is possible under some awkward conditions. Men on piecework provided with such a hammer, accept one-third the old piecework price. Their cost, duty and freight paid, is from $150 to $160, and much of their product is decidedly superior to hand work. This is especially seen in beading over the ends of boiler tubes. Air is used in ordinary vertical smithy hammers, having cylinders 10 inches by 28 inches, with what economy is not known, but as no choking exhaust pipe is needed, the exhaust is very free.

Riveting tools require little special mention, as any power riveting tool, acting by a single steady squeeze from water or steam, may be worked by air. At most the change is but one of valve or cock, so that all power movements are controlled by one handle, and if desired, the exhaust air may be directed on to the cooling rivet, as in some cases it is on the point of a drill to keep it cool. The pneumatic hand-hammer (with its rapid delivery of blows) is well suited for light tank work, that is, for rivets up to ½ inch diameter. The use of this tool—as in hand riveting—requires a holder-up. The number of rivets put home per hour, dependent on size, is increased from 50 to 100 per cent. over hand labor. The unpleasant noise it makes is in some quarters an obstacle to its increased use, and as its quickly repeated blow helps to keep up the heat of the rivet, it is probable that this rapid impact hammer will not prove to be as satisfactory on steam joints as it is on tank work, because, in hydraulic riveting, where the dead pressure can be held on the rivet while it is cooling, the amount of caulking required to finish and make a tight dry job is three or four times more than that usually required to make equally good a hand riveted boiler.

Common shop practice in the home manufacture of air lifts is to use for the cylindrical barrels seamless tubes of iron or brass, smoothed internally by forcing a slug through; for the piston rod cold rolled steel screwed at its lower end into the lifting hook shackle, and for piston head two cast iron disks with one thickness of leather packing between. To secure the satisfactory action of this leather packing a sprung ring of round steel or brass wire cut shorter than the barrel circumference, and bent larger than its diameter, is put inside the turned over edge of the leather packing, and the lower and smaller of the iron disks has cast in it, in its outer upper edge, a recess to clear and allow for the free play of this sprung wire ring. The two cast heads or covers, and the barrel which is slightly recessed into them, are held together by through bolts, outside the barrel. So made, of medium length, a 4-inch costs $18 and a 6-inch $28. Under such conditions of cheap make, the friction of working varies from 3 per cent. in the large sizes to 20 per cent. in the very small, that is 4-inch and under. This compares favorably with epicycloidal and differential hoisting tackle, but lacks, of course, its certainty of sustaining power. If two cast-iron sprung rings are used as packing in a solid piston head, the barrel needs boring out from end to end, and if not in fairly continuous use is liable to have the friction increased by rust. In a spring testing machine made by the author, with two cast iron spring rings ½ in. wide by ⅜ in. thick, working in a 20-in. cylinder, new and well lubricated, it took 100 pounds to start the piston, as indicated by a Salter balance, and 90 lbs. to keep it moving. In so simple a type of hoist it is a matter of indifference which way the cylinder is set. Given sufficient head room it is suspended vertically