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11. SINGLE STAGE PUMP DESIGN

The fundamentals of single stage pump design were outlined in Chapter 2 - Basic Compression Principles. The reader is referred to that Chapter as an introduction to this one. The term ‘single stage’ refers to the fact that air is compressed only once in a ‘one shot’ mode before being delivered through the non-return valve into the hose and tyre.

Pumping efficiency (volume of air compressed and delivered per stroke) is a therefore simply a function of the swept volume in the compression chamber on each stroke. This, in turn, is determined by the cross-sectional area of the barrel and the length of stroke made by the piston. Therefore, efficiency increases with size of pump and to some extent ‘bigger is better’. But in practice, the optimum size of a pump is governed by storage requirements and size of tyres needing inflating. They were therefore made in a wide range of sizes to suit all requirements.

Single stage pumps come in a variety of designs. Some compress forwards, with the outlet being at the front of the pump. Others compress backwards with the air outlet at the rear. The non-return valve is never deep inside the pump. It is either incorporated in the pump housing near the outlet or in the hose tail joining the hose to the pump barrel.

Some examples of single stage pumps are now shown and discussed.

The first is a Prima 555A – a forward pumping model with the non-return valve in the hose tail.

The illustration below shows three British Goodrich single stage pumps. Again these are forward pumping - but with the non-return valve this time located in the outlet orifice under the dial gauge. These are very attractive looking pumps.

A single stage Kismet Baby is shown next – restored to concourse/display condition. This is a backward pumping design with the non-return valve behind a brass bolt at the rear air outlet point.

An interesting variation on the normal single stage design is where two compression chambers are used in parallel – basically to double the volume of air compressed on each stroke. Each chamber compresses the same volume of air to the same pressure.

The two chambers can be physically in parallel or, as in the example of the BPT (Bristol Pneumatic Tools) pump shown below, arranged in a horizontally opposed fashion. In this design, the air outlet is at one end and the nearest piston delivers straight into this. The other piston, at the same time, compresses air in the other

chamber and delivers simultaneously to the outlet through a hollow interconnecting piston rod.

The mechanism by which the two pistons are simultaneously activated by one down stroke of the pedal can be seen. Also, the return spring (a parallel coiled tension spring) is shown. Coiled tension springs in vintage pumps are quite rare – the only other common examples being in the Dunlop Major and Standard.

This BPT pump is a beautiful looking beast, but a complete nightmare to overhaul! The design requires high quality seals where the piston rod passes through each cylinder and, because of the tolerances on the bore, the use of 'heavy oil' in recommended on the maker's name plate.

I've had three attempts to strip down, overhaul and re-washer this pump to get it working. Each time it has worked beautifully for a while and then started leaking. Must keep trying!!

Finally, a quirky little example of a single stage foot pump is shown below. This is a British Goodrich 'Junior' and it is indeed quite junior in size! It always brings a smile to my face. The tape measure is set at 10 cm. for scale. My wife calls it a 'ladies handbag pump'!

The working principle is very simple – pressing the foot down on the platform at the top drives a piston down the barrel underneath. There is a NRV in the hose-tail at the outlet at the bottom. There are three coiled compression return springs on the vertical supports. The swept volume in the barrel at each stroke is quite small – so lots of strokes needed to get up pressure.