Pneumatic Precision Pliers

This invention relates to a device for pneumatically operating a tool, which can be driven by means of pressure in accordance with the preamble in accordance with claim 1 as well as to pneumatic pliers.

Pneumatic pliers for the compression and clamping of locking rings, bolts, cable lugs, hose clamps, etc., are known. Especially known are the pneumatic pliers in the automobile industry, where these pliers are used for the clamping of locking rings in the assembly of hoses, bellows etc. to supports, universal joints and similar.

A pressure plier for springs is known from DE 37 42 782, with a valve controlled pressure connection and a wedge-shaped forward feed element.

In the German registered patent 89 00 250.4 a similar pressure plier is described in which several pistons fitted in series one behind the next are provided for increasing the thrust, where the piston rod of each individual piston is guided into a cylinder wall. Similarly, more pressure pliers comprising of pressure pistons arranged in line are described in DE 195 19 543 and GM 295 09 976.

The principle of increasing force through several non-positively fitted pistons for generating a translatory force has already been known for a long time, such as described, for example, in the European patent document EP 0 997 647 and the German registered patent DE-GM 91 11 366.0.

The transference of the translatory force, especially in pneumatic pliers, such as for example in the above mentioned pressure pliers, occurs in an arc-shaped force in the plier head through the use of a wedge shaped feed tool. The

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compression force on the jaws of the plier is dependent, among other things, on the thrust of the feed tool.

The concepts known from the current state of technology exhibit strong dispersions of the compression forces; they generally do not maintain their compression force at a constant pressure and they lose their compression force during the serviceable life. Another disadvantage lies in the fact that the known compression pliers are not maintenance free.

It is therefore a task of this invention to create pneumatically operated pliers of the known type without the above disadvantages.

In accordance with the invention this appointed task is solved using a device in accordance with the wording in claim 1.

A device is proposed for the pneumatic operation of a pressurized tool, such as in particular, a pneumatic plier, comprising a cylinder with one or several pneumatically operated, non-positively fitted pistons arranged in line for the generation of a translatory force, the respective piston rods of each piston as well as one forward feed element or elements actively bound to the pistons for the operation of the tool are held and guided by a guidance ring or more precisely by a cylinder wall. What is more in accordance with the invention it is proposed that two rings, each peripherally encompassing the outside of the piston or pistons are provided to seal against the inner wall of the cylinder tube.

According to a variation on the execution of this invention at least one of the rings is a piston guidance strip.

According to a further variation on the execution at least one of the rings is a so-called lip seal.

Lip seals display less static friction as well as lower dynamic friction. Piston guidance strips avoid contact between the piston, or more precisely the piston head or piston face and the cylinder and thus contribute to the smooth running characteristic of the piston. Ultimately these measures contribute to the device being maintenance free in accordance with the invention.

In order to guarantee the translatory force constant of the individual pistons fitted in line, among other things the row of pistons is guided against the foremost piston and sealed using a sealing element, for example an o-ring.

Other preferred variations of execution of the device in accordance with the invention are characterized in the attached claims. The device in accordance with the invention is especially suitable for pneumatic pliers for the placing, pressing or clamping of locking rings, bolts, cable lugs, hose clamps and similar items.

The great advantage of the device in accordance with the invention lies in that the translatory force remains constant with constant pneumatic pressure. The result is a constant pressing force with structurally similar pliers and with the same pneumatic pressure. Finally, the pressing forces remain constant throughout the entire serviceable life of the device proposed in accordance with the invention.

By the fact that the tool to be operated can be fitted, preferably removeably, to the device, the device in accordance with the invention is also universally usable for the operation of pneumatic tools. In other words this invention is not limited to plier tools, but may also be used for any other tools, which can be operated by pneumatically operated forward feed elements and by using translatory force.

The invention is now explained in the following in more detail with reference to the enclosed figures.

Figure 1: shows in a longitudinal section, pneumatic pliers modeled in accordance with the invention and

Figure 2: shows as an enlargement, a section of the drawing in figure 1.

In a longitudinal section figure 1 shows pliers (1) which are pneumatically operable and can be driven by means of pressure for the purpose of building pipe clamps, hose clamps, locking rings, etc.. In a cylinder (3) several pistons (5) are arranged in series, or more precisely, in a line one behind the other. The advantage of these pistons arranged in a line is an increase in the force, because the translatory force that can be generated is significantly higher than with the use of a single piston. One reason for this is the enlargement of the piston surface.

A connection (8) is provided at the back end of the hand operable pneumatic pliers for connecting the pliers to a pressure medium, such as for example to compressed air, where the pressure supply can be opened using a valve lever (7) for the activation of a valve (9) or more precisely be deventilated. The individual pistons (5) comprise a connecting passage (10) through the piston rods (6) for the passing through of the pressure medium. Exit openings (11) are provided in the area of the front side end of the piston rods (6) and are aligned radiating outwards for the pressurized air to exit and for the activation of the next piston (5) in the direction of the plier tool. The next piston in the sequence (6) is driven forwards by the air pressure and the pressurized air passing through the connecting passage of the next piston rod in the sequence is repeated in an analogous fashion.

There are stem holes (28) in the piston sequence (5, 34) for reliable non-tilting, feeding in of the piston rods into the next piston, which

are sealed using an o-ring (25). The cylinder lids (13) which are securely positioned using sealing rings (14), serve for fluid separation of the individual pistons and are sealed with a sealed scraper ring (24), so that each piston with its cylinder lid that belongs to it (13) constitutes a fluid unit.

The so-called wedge piston (34) follows the leading piston (5) in the direction of the plier tool, an arc-shaped forward feed element (35) is provided on the front side of this piston to operate the head of the pliers (38). Both of the jaws of the pliers (36), lodged for example in bolts (39) are dispersed using the forwards circulating piston which uses the pressurized agent, such as for example pressurized air, in the area at the back while the piston surface moves between two rolls (40). Simultaneously, both of the jaws of the pliers (36) are moved together in the direction of closure at the front, for example, for the clamping of a clamp or more precisely for the pressing of lug clamps or similar items through operation of the pliers (42).

The head of the pliers (38) is preferably bound using a union or swivel joint (43) which is interchangeable with the cylinder (3). In addition, the jaws of the tongs (36) are protected along the side against contact (accident protection) or dirt accumulation using cover plates (46).

Now there will be more detail on the characteristics of the essentials of the invention with the help of a section from figure 1 in the longitudinal section of figure 2. So the piston (5) comprises piston packing (22) as well as a piston guidance strip (23) against the cylinder tube wall (3). The piston packing (22) is preferably a so-called lip seal. The use of lip seals in particular produces low friction as well as lower dynamic friction. The piston guidance strip (23) avoids contact of the piston with the cylinder tube and in this way contributes to the smooth running characteristic of the pistons and further leads to freedom from maintenance of the plier tool proposed in accordance with the invention.

Another ingenious characteristic lies in the use of a lip seal (24), using which the piston rod (6) is sealed from the piston lid (13). Furthermore, the piston rod (6) reaches up into the piston head (12) and comprises an additional seal (25), such as for example, a so-called o-ring, in the edge area of the front end. This measure leads to constant translatory force at constant pneumatic pressure.

Additionally, parts analogus to figure 1 are shown in figure 2 with the same reference numbers so there is no need for a repetition of the functionality of the pressurized device.

With regard to the pneumatic pliers shown in figures 1 and 2 this is naturally only a single example, which should serve for a better explanation of this invention. The invention is in no way limited to pneumatic pliers and instead relates to all sorts of pneumatically operable tools, which can be driven by means of pressure, which comprise a thrustor pipe with one or more pneumatically operated, non-positively fitted pistons arranged in line for generating a translatory force, as described in accordance with the invention. In figures 1 and 2 importance is particularly placed on the explanation of the characteristics in accordance with the invention and all characteristics known from the state of technology, construction parts and similar for devices of the type described can be combined in any number of ways in accordance with the characteristics fundamental to the invention. The further development of the device in accordance with the invention will not be dealt with here, such as for example, electronic control, the installation of monitoring sensors, the automated operation of the device in accordance with the invention, the choice of materials for the device in accordance with the invention

if this should be steel, aluminum or if need be partially using strengthened polymer materials etc.

By interchanging the plier tool the device shown in figures 1 and 2 may be used as any other tool, which can be driven by means of pressure such as, for example, as a boring tool, a punching or cutting tool, a screwing tool etc.

Legend for the figures:

1	pneumatic pliers
3	cylinder
5	pistons
6	piston rods of the pistons 5
7	valve lever
8	opening for the pressure medium
9	valve
10	connecting passage in the piston 5
11	outlets
12	piston head
13	cylinder cover
14	sealing ring
22	piston packing (between piston 5 and cylinder 3)
23	piston guidance strip (for guidance)
24	seal - scraper ring (sealing between the piston rod of the piston 5 and the cylinder lid 13)
25	seal between the piston rod of the preceding piston in the row of pistons, e.g. o-ring
28	stem hole
34	wedge piston for retaining the wedge 35
35	wedge
36	jaw of the plier
37	plier union or joint
38	head of the plier
39	bolts
40	roll
42	pliers
43	swivel nut or union nut
46	cover plate

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CLAIMS

1. A device for pneumatically operating a tool, especially pneumatic pliers, comprising a cylinder with pneumatically operated pistons arranged in line for generating a translatory force, each piston being supported by the internal cylinder wall by means of a piston guiding band and having a piston rod which is sealed against the adjacent piston and guided in a cylinder cover, and a component functionally connected to the last piston for operating the tool, characterized by a seal sealing the edge area of each piston rod with respect to the adjacent piston.

2. A device according to claim 1, wherein each piston rod extends into the adjacent piston.

3. A device according to claim 1 or claim 2, wherein the piston rod is sealed with respect to a corresponding cylinder cover by means of a lip seal.

4. A device according to claim 1 or claim 2, wherein the piston rod is sealed with respect to a corresponding cylinder cover by means of a wiping seal ring.

5. A device according to claim 3, wherein the seal sealing the edge area of each piston rod is an o-ring.

6. A device according to any preceding claim, wherein the component for operating the tool is a wedge adapted to transfer the translatory force to two jaw type pieces, each sliding along the wedge surfaces.

7. A device according to claim 6, wherein the component for operating the tool is screwed into the last piston and is guided in a plier holder.

8. A device according to any preceding claim, wherein the tool head is releasably connected to the cylinder.

9. Pneumatic pliers for fitting and pressing clamp rings, hose clamps, tube clamps, hose clips, lug clamps comprising a device in accordance with any one of claims 1 to 8.