

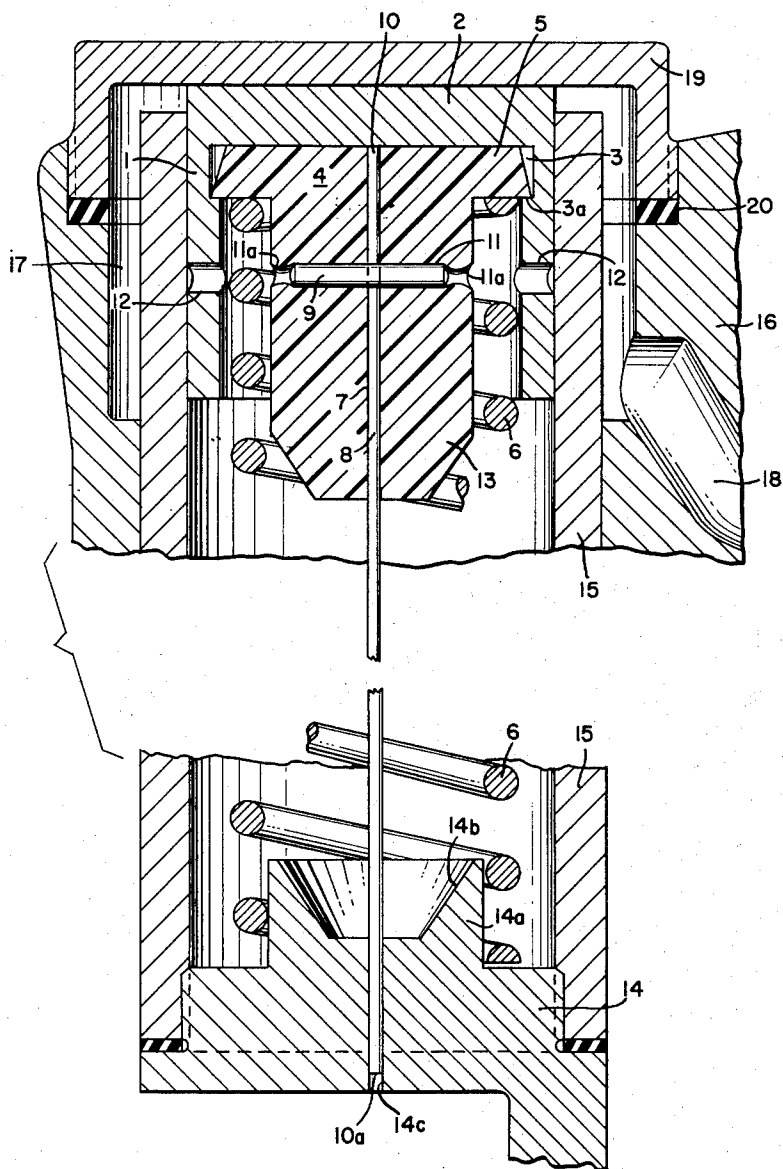
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H. E. BADE

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PORTABLE STAPLER, ESPECIALLY DRIVER CONNECTION THEREFOR

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INVENTOR
HEINZ E. BADE

BY

Walter B. Baker

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PORTABLE STAPLER, ESPECIALLY DRIVER CONNECTION THEREFOR

Heinz E. Bade, Hamburg-Garstedt, Germany, assignor to Joh. Friedrich Behrens, Ahrensburg, Holstein, Germany

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The present invention relates to portable staplers, and, more specifically concerns the connection of the staple driver to the reciprocable piston of the stapler. In portable staplers with pneumatic operation of the stapler piston of the general type as disclosed, for instance, in U.S. Patent 2,983,922, the driver represents one of the components which, during operation of the stapler, are subjected to unusually strong stresses. Especially the connection of the driver to the piston driving the same is subjected to extremely severe stresses in view of the accelerating and inertia forces at the high number of strokes per time unit customary with such staplers.

It is, therefore, an object of the present invention to provide a driver connection which will advantageously resist such stresses, even during permanent operation, over a long period of time.

It is another object of this invention to provide a driver connection as set forth in the preceding paragraph, which, while highly resistant to the stresses occurring in the stapler, will be relatively simple in construction.

It is still another object of this invention to provide a driver connection as set forth above, which includes means adapted during empty shots to absorb the effect of the inertia forces of the quickly moving driver at the sudden resistanceless termination of the piston stroke.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing illustrating a vertical section through the cylinder portion of a stapler with the driver connection according to the present invention.

The driver connection according to the present invention is characterized primarily in that the driving leaf or driver is journaled in an insert of elastic material which insert is firmly located in an inverted cup-shaped reciprocable piston, the arrangement being such that said driver is so located in said insert that that end face of the driver which is remote from the staple contacting end face is firmly held against the bottom of said piston while a pin firmly embedded in said insert extends through said driver.

The metallic engagement of the above-mentioned end face of the driver with the piston bottom will assure the immediate positive transfer of the forces exerted upon the piston to the driver, and that this piston power flow will be maintained up to the end of the driving stroke, without exerting any material stress upon the holding pin embedded in said insert and passing through said driver. Due to the fact that said holding pin is firmly embedded in the elastic insert, the pin is yieldably journaled in said insert so that said pin will not be subjected to any material shearing stresses which are unavoidable before the end of the driving stroke, if the pin were journaled in the rigid walls of the piston, as is the case with heretofore known driver connecting arrangements for the driver.

Referring now to the drawing in detail, the arrangement shown therein comprises the driver piston 1 of inverted cup-shaped form provided with a bottom 2. Adjacent the inner side of said bottom 2 there is provided an annular groove 3 providing a shoulder 3a. The said shoulder 3a and the bottom 2 are engaged by the base portion or mushroom-shaped head 5 of a cylindrical insert

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4 of elastic material, preferably selected from the polyurethane group, which has the desired hardness and yieldability. In this way, the insert 4 is firmly held in the piston for movement therewith.

The head 5 forms the abutment for one end of a helical spring 6 which is intended for returning the piston to its starting position after completion of its working stroke under the influence of compressed air. It will, of course, be understood that if the stapler is provided with pneumatic return, as in the case, for instance, in the stapler arrangement of Patent 2,983,922, the spring 6 may be omitted. The insert 4 is provided with an axial longitudinal slot 7 in which is inserted a correspondingly shaped steel leaf forming the driver 8 for the stapler. This driver 8 has that end face 10 thereof which is remote from the staple contacting end face 10a in direct positive engagement with the inner side of the piston bottom 2, and is held in this position by a transverse pin 9. The pin 9 which extends through the driver 8 is located in a radial bore 11 extending all the way through insert 4, and is secured in this position by the transverse contractions 11a at the ends of bore 11. For purposes of driving the pin 9 into bore 11, the wall of the piston 1 is provided with two diametrically oppositely located openings 12 through which a corresponding driving tool can be inserted.

The lower end 13 of insert 4 has the shape of a truncated cone. Piston 1 is reciprocably mounted, in customary manner, in the stapler cylinder 15, the lower end of which is threadedly engaged by a closing member 14 closing the lower end of the cylinder 15 and having an axial slot or passage 14c for receiving and guiding the lower end of staple driver 2. The closing member 14 forming the bottom for cylinder 15 has an inwardly protruding portion 14a with a truncated cone-shaped recess 14b which corresponds in shape substantially to the truncated cone-shaped lower end 13 of the insert 4, but is slightly narrower than said truncated cone-shaped end 13. Member 14 also forms the abutment for the lower end of spring 6.

The cylinder 15 is mounted in a housing 16 with a recess 17 communicating through a passage 18 in customary manner, with the compressed air supply and exhaust means, as is well known in the art. The top portion of housing 16 is closed in customary manner, for instance, by a cap 19 and seal 20.

Due to the fact that the driver end surface 10 is in direct positive engagement with the piston bottom 2, it will be evident that when the driving stroke is started by compressed air acting upon the piston bottom 2, the latter will take the driver 8 with it. It will also be obvious that during this phase of operation, the holding pin 9 will not be subjected to any stresses at all. The positive power flow between piston and driver remains maintained during the entire driving operation. Also, when the return stroke is initiated and carried out by the spring 6, which, during the driving stroke was compressed, pin 9 will, due to its being embedded in the elastic insert 4, not be subjected to any shearing stresses.

The journalling of the driver according to the present invention and as described above, is of particular importance in connection with the carrying out of an idling stroke. It will be appreciated that with an idling stroke, the conversion of the live energy of the piston with insert and driver into the work for driving a staple into a workpiece, will not be present. Consequently, with the thus shock-like braking of the piston and insert 4 at the stroke end, the driver 8 will tend to continue its movement, and, with heretofore known arrangements, will exert a considerable shearing force upon the holding pin. With the arrangement according to the present invention, however, this stress will be considerably reduced due to the fact

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that pin 9 is yieldably journalled, i.e., is journalled in the yieldable elastic material in which it is embedded so that the pin, even though only to a slight extent, can still yield in a shock-decreasing manner.

Furthermore, the further movement of the driver is effectively braked by the fact that the truncated cone-shaped end 13 of insert 4 will, at the end of the driving stroke, be driven into the somewhat narrower recess 14b while simultaneously being compressed in radial direction. This has the effect that the walls of slot 7 will, within the range of the end 13, firmly be pressed against the driver leaf whereby the latter will be prevented from its tendency during an empty shot, to move out of the insert 4 at the end of its driving stroke. The high cushioning effect of the polyurethane, of which the insert 4 is preferably made, will have its beneficial effect, particularly when pressure and shearing stresses are exerted.

The tendency of the insert 4, during an empty shot, to lift itself off from the piston bottom in view of the sudden complete braking of the piston, can be counteracted by fitting said insert into the piston at such a close fit that a suction effect will be exerted upon insert 4, which suction effect will have the tendency to hold said insert permanently in engagement with the piston bottom.

It is, of course, to be understood, that the present invention is, by no means, limited to the particular construction shown in the drawing, but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. For use in connection with a stapling tool: an inverted cup-shaped piston having a bottom and a cylindrical skirt, an elastic insert in said piston, said piston including means totally within the confines of said piston for firmly holding said insert in said piston for movement therewith in opposite directions of movement of said piston, said insert having a passage therethrough extending in axial direction of said piston, staple driving means in said passage, one end of said staple driving means being normally firmly held against said bottom and the other end of said staple driving means protruding from and beyond said insert, and holding means firmly embedded and journalled in said elastic insert only whereby said holding means is yieldably journalled in said insert, said holding means extending through said staple driving means so as normally firmly to hold said staple driving means against said piston bottom.

2. For use in connection with a stapling tool including a cylinder: an inverted cup-shaped piston reciprocable in said cylinder and having a bottom and a cylindrical skirt provided with an annular groove adjacent said bottom, an elastic insert having a base portion engaging said bottom and being held in said groove for engagement with said piston in opposite directions of movement of said piston, said insert having a passage therethrough extending in axial direction of said piston, staple driving means in said passage, one end of said staple driving means pro-

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truding from and beyond said insert, and pin means firmly embedded along its entire length in said elastic insert whereby said pin means is yieldably journalled in said insert, said pin means extending through said staple driving means so as normally firmly to hold the other end of said staple driving means against said piston bottom.

3. An arrangement according to claim 2, in which said elastic insert consists of a synthetic material with high cushioning properties.

4. An arrangement according to claim 2, in which said elastic insert consists of polyurethane.

5. An arrangement according to claim 2, in which said insert has a bore therethrough extending in a direction transverse to the longitudinal extension of said staple driving means and having said pin means located therein, the length of said pin means being less than the length of said bore so that after insertion of said pin means into the central portion of said bore the ends of said bore are free.

6. An arrangement according to claim 5, in which the ends of said transverse bore are constricted relative to the diameter of said pin means.

7. In combination in a stapling tool: a cylinder, a cylinder bottom member closing one end of said cylinder and being provided with a frusto-conically shaped recess, an inverted cup-shaped piston having a bottom and a cylindrical skirt and being reciprocally mounted in said cylinder, an elastic insert arranged in said piston, said piston including means firmly holding said insert in said piston for movement therewith in opposite directions of movement of said piston, said insert having a passage therethrough extending in axial direction of said cylinder, staple driving means in said passage, one end of said staple driving means being in engagement with said piston bottom and the other end of said staple driving means protruding from said insert and being operable to extend through said cylinder bottom member for engagement with a staple to be driven, and holding means journalled in said insert only and extending through said staple driving means and holding the said one end of said staple driving means in engagement with said piston bottom, that end of said insert which faces away from said piston bottom being frusto-conically shaped for abutment with said cylinder bottom member at the end of the staple driving stroke of said staple driving means and being adapted to be received in the recess of said cylinder bottom member, said frusto-conically shaped end of said insert being of a size slightly larger than the frusto-conically shaped recess in said cylinder bottom member, said cylinder bottom member being provided with a passage arranged in axial alignment with said passage through said insert to receive said other end of said staple driving means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,850,738	Campbell	Sept. 9, 1958
3,041,614	D'Haem	July 3, 1962