ABSTRACT
A release safety mechanism in a pneumatically operated stapler is equipped with a superimposed member displaceable in the direction of superimposition and projecting in its condition of rest beyond the mouth piece of said stapler. In conjunction with a release lever of the stapler the movement of an intake valve at the working cylinder can be controlled. Therefore a ball valve is connected to the intake valve via a tube traversing a compressed-air reservoir of the stapler. Said ball valve can be actuated both by the superimposed member and the release lever.

1 Claim, 4 Drawing Figures
STAPLER RELEASE SAFETY MECHANISM

The invention relates to a release safety mechanism to be used in pneumatically operated staplers or nail driving apparatus, and particularly to safety mechanism having a superimposed member movable in the direction of superimposition and projecting in the resting condition beyond its mouth piece or nozzle by means of which in conjunction with a release lever in operating position the movement of an intake valve at the working cylinder can be controlled.

Release safety mechanisms utilized in pneumatically operating staplers or nail driving apparatus in the form of two-way mounted levers which can be displaced mechanically are known in the art. The manufacturing tolerance of the product renders the use of release safety mechanisms of this type problematical since such safety mechanisms must operate with a very high degree of precision and with possibly no delay. Small deviations in the accuracy of the finished product, which are always present to some extent, can hardly be circumvented or compensated in mechanically displaceable levers used as release safety. Besides, it is required to make use of large strokes with a corresponding time delay when a stapler or nail driving apparatus is set operating.

Furthermore, it is known to use valves connected sequentially so as to open or close the path for the compressed air in stages or steps. Release safety mechanisms of this type are however technically complicated as well as expensive and do not achieve the short switching time required for rapidly operating tools. A prior art release lock has been disclosed in the U.S. Pat. Specification No. 3 490 545 wherein an auxiliary piston forms the upper prolongation of the cap or superimposed member and is coupled to an initial valve via a twin-armed toggle lever, causing in the no-use condition of the superimposed member and/or of the release lever the air space between the auxiliary piston and the valve tappet to communicate with the compressed air reservoir and being vented only when the superimposed member and the release lever are in operating condition so that after ventilation of the air space the valve rod can initiate the working stroke of the stapler. Utilizing a separate initial valve as well as uniting the auxiliary piston with the superimposed member renders the entire release locking means expensive and cumbersome inasmuch as the switching time achieved is, even with constructions of this type, not sufficiently short enough.

It is therefore an object of the invention to construct a release lock means of the type mentioned at the outset such that the switching time for triggering the working stroke of the working piston is substantially shorter while requiring less cost and outlay than those of prior construction. This aim of the invention is characterized in that a changeover ball valve of known construction is connected via a tube traversing the compressed air reservoir to the intake valve for the working cylinder and operable both by the superimposed member and the release lever. In accordance with another feature of the invention there are provided two entirely identical release valves capable of being actuated by the superimposed member and the release lever and having the form of auxiliary pistons having each two gasket rings spaced with respect to one another to alternately seal off the compressed air reservoir and the apparatus housing from the atmosphere, which valves are arranged symmetrically relative to the changeover ball valve connecting via bores with the release valves. As safety measure against excessive outward displacement of the release valves limit stops may be provided at their ends reaching into the compressed air reservoir.

The switching time of the release safety mechanism according to the invention is so short when using the changeover ball valve that the working stroke may be triggered practically when setting the stapler down on the workpiece, provided the release lever has been made to take up the release position.

An embodiment according to the invention is shown schematically in the drawings wherein:

FIG. 1 is a lateral, partially sectional view of the pneumatic stapler in the position of no-use,
FIG. 2 is an illustration at an enlarged scale of the release safety mechanism together with the release lever in operating position,
FIG. 3 is a representation according to FIG. 2 in which the superimposed member is in operating condition, and
FIG. 4 is an illustration of the release locking means according to FIGS. 2 and 3 showing the release lever and the superimposed member in operating position.

The stapler shown in the partially sectional view in FIG. 1 is pneumatically operated to drive staples, clips, or nails into a workpiece (not shown). The body 1 of the apparatus consists e.g. of light metal and is provided with a handle 2 enclosing an air receiver or compressed air reservoir 3 connected to a source of compressed air. In the front part of the body 1 a working cylinder 4 is inserted slidably housing a piston 5. This piston 5 drives a ram 6 which separates a staple from a staple bar inserted in magazine 7 during the working stroke and drives it through a discharge channel 9 provided in the nozzle 8 into a workpiece (not shown).

The working stroke of the stapler is triggered by a changeover ball valve 10 communicating via tube 11 with the intake valve 12 of the working cylinder 4. In the upper end position shown in FIG. 1 the intake valve 12 is closed and the piston 5 is in its initial or starting position lying flush with the housing cover 13. Symmetrically on both sides of the changeover ball valve 10 there are mounted release valves 14 and 15, the first of which can be actuated by release lever 26 and the latter by the superimposed member 32. Said release valves 14 and 15 take the form of auxiliary pistons 16 and 17 and are provided each with gasket rings 18, 19, 20 and 21 spaced one from the other. At the ends reaching into the compressed air reservoir the auxiliary pistons 16 and 17 have stops 22 and 23 mounted thereon so as to be protected against excessive displacement. The release valves 14 and 15 are connected via channels 24 and 25 to the changeover ball valve. The ball as circuit component of the changeover ball valve 10 is indicated at 27.

The mode of operation of the invention is as follows:
In the basic non-operating position both of the release lever 26 and the superimposed member 32 pistons 16 and 17 of the release valves 14 and 15 are pressed downward by the pressure in the compressed-air reservoir 3. The gasket rings 19 and 21, respectively, prevent compressed air to flow from the compressed air reservoir 3 past pistons 16 and 17 and via bores 24 and 25 into the changeover ball valve pass and outward into the atmosphere. The ball 27 is thereby pressed against
the lower end of the tube 11 traversing the compressed-air reservoir. However, compressed air is permitted to pass into tube 11 through the slots provided at the lower end thereof and to penetrate up to the top of intake valve 12 which is thus held in closed position. Actuation alone of release lever 26 (FIG. 2) will lead to seal off the upper part of the release valve 14 and also to vent the bore 24 so that the ball 27 can take up its sealing position in front of the orifice of said bore 24. As before, compressed air from the compressed air reservoir 3 can act upon the bore 25 via release valve 15 while the changeover ball valve and bore 11 admit compressed air to act upon intake valve 12 which remains unchanged in its closed position. The same effect is produced when, in place of the release lever 26, solely the superimposed member 32 is actuated (FIG. 3). This is assured due to the entirely symmetrical form and arrangement of the release valves with respect to the changeover ball valve 10.

As soon as, however, in addition to the release lever 26 the superimposed member 32 is actuated e.g. by setting the stapler down on a workpiece, as illustrated in FIG. 4, any further admission of compressed air from the reservoir 3 to the changeover ball valve is interrupted. At the same time the bores 24 and 25 are vented since the gasket rings 19 and 21 lay open sufficiently large opening cross section to the atmosphere when the pistons 16 and 17 move upward. Since there exists an immediate communication via tube 11 between the bores 24 and 25 to the top of the intake valve 12 this valve 12 is relieved, and the compressed air present in reservoir 3 can push said intake valve 12 upwardly and come to act upon working piston 5.

The ball 27 has only to cover a very short switching path within the changeover ball valve 10 so that the switching time is kept so short that the working stroke sets in practically when the stapler with its release lever 26 is placed on the workpiece.

What I claim is:

1. A release safety mechanism for a pneumatic stapler and nail driver, said mechanism comprising a casing having a compressed air reservoir and a separate working cylinder, an inlet valve in said cylinder, a piston movable in said cylinder in response to air pressure controlled by said inlet valve, a driving ram connected with said piston, a tube extending through said reservoir and having one end communicating with said inlet valve, said tube supplying compressed air to said inlet valve to keep it in a closed position, valve means connected with the other end of said tube, said valve means comprising a body carried by said casing and having a central chamber with an opening communicating with said other end of the tube and two passages spaced from and extending on opposite sides of said opening, a ball located in said chamber, said ball being movable to close any one of said passages in response to pressure differential between said passage and constituting with said chamber a ball valve, two auxiliary valves, each of said auxiliary valves having a space connected with a separate passage and having a separate valve piston located in said space and extending symmetrically to said ball valve, each valve piston having an end portion extending into said reservoir, and an opposite end portion extending to atmosphere, two separate gasket rings carried by each valve piston to seal off the respective space alternately from the atmosphere and said reservoir, a separate stop carried by each valve piston upon its one end portion extending into said reservoir and adapted to engage said body to prevent excessive displacement of each valve piston, and separate trip means adapted to engage said opposite end portions to actuate said valve pistons, whereby compressed air keeps either of said inlet valve in the closed position when said trip means are not actuated and in the open position only when both said trip means are actuated.