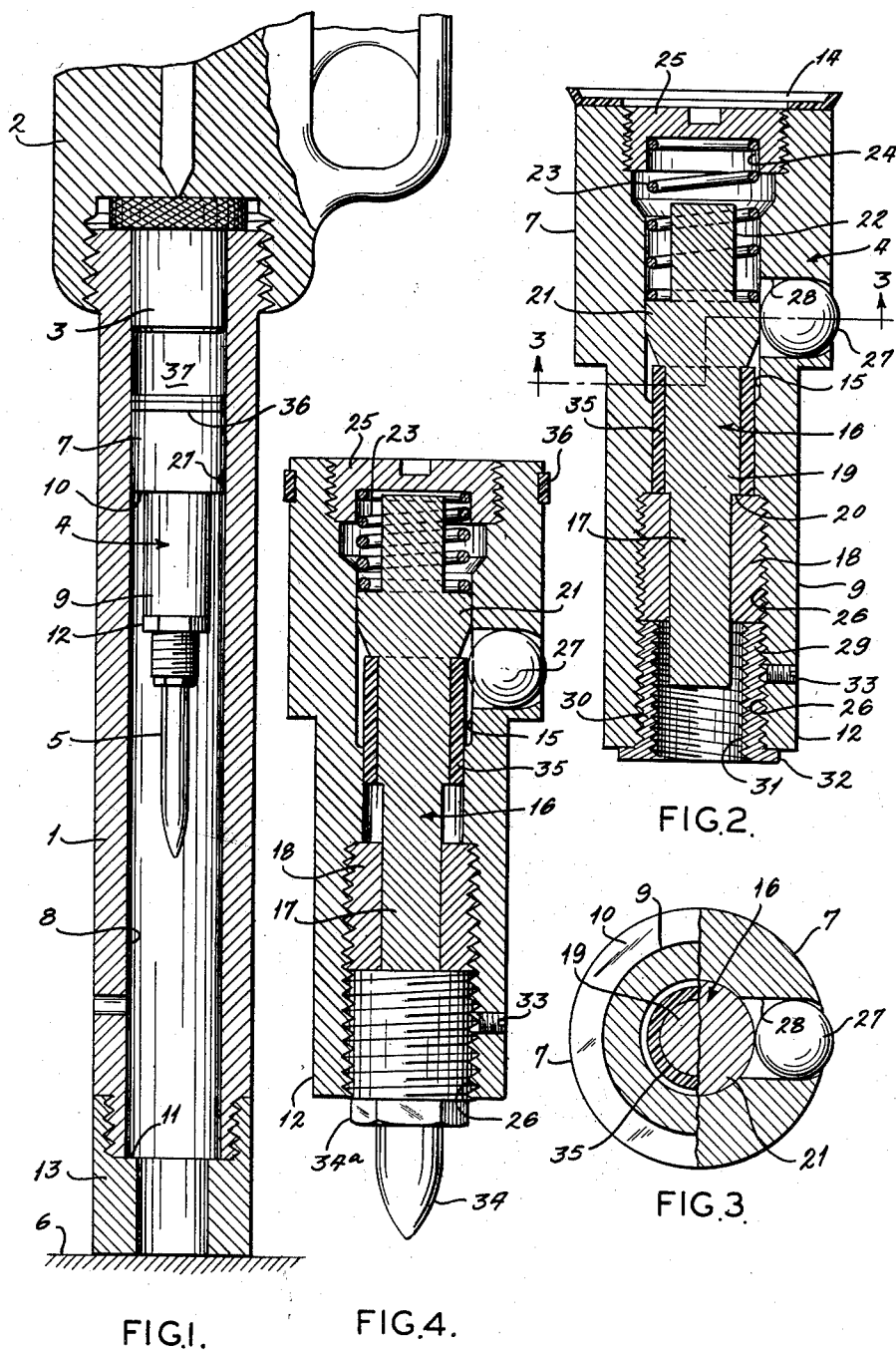


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SAFETY AND CONTROL RAM

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INVENTORS:
ELMER F. PFAFF
ROWLAND J. KOPE
By Lionel S. Doff and Robert K. Humali
ATTORNEYS

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SAFETY AND CONTROL RAM

Elmer F. Pfaff, Mantua, and Rowland J. Kopf, Rocky River, Ohio, assignors to Portable Industries, Inc., Cleveland, Ohio, a corporation of Ohio

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This invention relates to a driving ram for a fluid powered tool and more specifically to a ram for preventing free flight of a driven member, such as a punching or cutting element or a fastener, upon discharge from the tool and to permit the driven member to be discharged from the tool with a selective predetermined force.

Fluid powered hand tools are used to perform many functions such as punching sheet metal, cutting off rivet heads and driving fasteners into concrete and steel, to name but a few. These tools are most commonly of the pneumatic or explosive type. Irrespective of the particular type, these tools commonly have a bore through which a driven member, such as a fastener, is propelled and from which it is discharged. From a safety viewpoint it is necessary that the driven element be prevented from entering free flight, that is, the driven member should remain attached to the tool so that it cannot fly through the air in the manner of a bullet. It is highly desirable that the force with which the driven element leaves the bore of the tool is neither too small nor too great but rather, the force should be just sufficient to do the immediate job for which it is intended. For example, if a fastener is to be driven into a thin steel sheet less force is required than if it is to be driven into a thick steel sheet. It is also very desirable that the tool be readily converted to different uses, for example, that the same basic tool may be utilized as a cutting tool, a punching tool or a fastener driving tool.

It is therefore an object of this invention to provide a tool in which the driven member is secured to the tool so as to prevent free flight of the element. Another object of this invention is to provide a tool wherein the driven member may be discharged from the tool barrel with a selectively predetermined force. Another object of this invention is to provide a tool which can be easily modified for use as a punching, cutting or fastener driving tool. Another object of this invention is to provide a tool in which driven members of the same type, such as fasteners, will be driven with substantially the same force irrespective of weight or size of the individual fastener, other factors being constant. Another object of this invention is to provide a ram for holding a member to be driven through the barrel of a fluid powered tool. Another object of this invention is to provide a ram which cannot be inserted into the barrel of the tool until the driven member is properly emplaced in the ram. Another object of this invention is to provide a ram which has non-expendable provision for dependably holding itself at the desired position in the bore of a fluid powered tool. Another object of this invention is to provide a tool having a ram for securely holding a threaded driven member, without damaging the threads on the driven member.

Additional objects and advantages will become apparent from the following description and drawings in which:

Figure 1 is a longitudinal sectional view of a portion

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of a tool showing a driven member, in this instance a fastener, secured to a ram and ready to be driven through the tool barrel bore;

Figure 2 is a longitudinal sectional view of the ram shown in Figure 1 but removed from the barrel and prior to insertion of the driven element, with the addition of one embodiment of a ram seal;

Figure 3 is a sectional view taken on the line III—III in Figure 2;

Figure 4 is a longitudinal sectional view of the ram, similar to Figure 2, but ready for insertion into the tool barrel with a punching tool screwed into the ram and showing another embodiment of a ram seal.

Fluid powered tools of the type for which the present ram 4 is intended include a barrel 1 having a bore 8 through which a driven member such as a punch 34, cutter or a fastener 5 is propelled by the action of a driving fluid, as in pneumatically or explosively powered tools. The ram 4 is telescopically received in the bore of the tool and has a front end 12 adapted to receive the driven member. The rear end 7 of the ram engages the bore with a substantially fluid tight sliding fit and may be provided with a seal to facilitate more efficient utilization of the driving fluid by preventing escape of the fluid past the ram. The body portion of the ram is provided with a longitudinal bore in which a spring pressed plunger 16 is telescopically received. The plunger has a cam portion 21 which maintains a ball projecting outwardly from the body portion of the ram. In this position the ball acts as a stop, preventing insertion of the ram into the tool barrel bore. To insert the ram into the barrel bore the ball must first be telescoped into the ram body by screwing the driven member into a bore 26 in the front end of the ram to telescope the plunger rearwardly into the ram body. The ball is then free to move inwardly so that the ram can be inserted into the tool bore with the driven member properly secured to the ram. With the driven member properly screwed into the ram the ball engages a resilient sleeve 35 on the plunger and upon insertion of the ram into the tool bore the ball is urged against the tool bore to frictionally prevent movement of the ram in the bore prior to firing the tool.

Referring to Figure 1, a tool barrel 1 is detachably connected to a breech block 2 in any conventional manner. A breech plug 3 for receiving an explosive cartridge is positioned in the breech end of the barrel bore. Immediately ahead of the breech plug is a ram 4 which has secured to its front end a driven member, for example a threaded fastener 5 to be embedded into a structural member 6 upon discharge of the cartridge. To prevent damage to the fastener threads as it is being driven into a structural member 6 the fastener is threaded into the ram. The ram has an enlarged body portion 7 which closely engages the bore 8 of the barrel with a substantially fluid tight sliding fit. The forward portion 9 of the ram receives the fastener 5 and has a reduced cross section providing a shoulder 10 which is adapted to engage a similar shoulder 11 at the discharge or muzzle end of the barrel 1. Should the fastener 5 be propelled with sufficient force to be driven clear through the structural member 6 engagement of the shoulders 10 and 11 prevents the fastener and ram escaping from the tool. The fastener 5 must be removed from the ram 4 after being driven into the structural member 6 and this may be accomplished in a number of different manners such as by providing an appropriately beaded portion 12 on the front end of the ram to receive a wrench, or by forming the shoulder 11 at the muzzle end of the barrel 1 as a separate detachable element 13 screw threaded to the barrel. If the shoulder is a separate piece it is merely

necessary to unscrew the tool and remove the ram from the bore of the barrel.

In Figure 2 the ram 4 is shown in longitudinal section removed from the barrel of the tool prior to securing the fastener 5 in the ram and with the addition of a seal 14 to the rear or breech end of the ram. This seal is a resilient cup shaped member having a cut out center portion to permit removal of the plug 25. The ram body has a longitudinal bore 15 which telescopically receives a plunger 16. The plunger has a front portion 17 telescopically received in a plug 18, a sleeve receiving portion 19 slightly larger than the front portion 17 to provide a shoulder 20 for abutment against the plug 18, a cam portion 21 comprising a cylindrical section and frustoconical section and a reduced rear portion 2. A spring 23 is seated between the rear face of the cylindrical cam portion 21 and a socket 24 in a closure plug 25 threaded into the rear end of the longitudinal bore 15 in the body portion of the ram. The spring 23 acts to normally maintain the plunger 16 in the forward position with the shoulder 20 in engagement with the plug 18. The front portion of the longitudinal bore is provided with threads 26 to receive the plug 18. A hard ball 27 is telescopically received in a radial bore 28 in the ram body. The outer end of the radial bore is of smaller diameter than the ball to maintain the ball in the bore. As a fastener is screwed into the threaded portion 26 of the longitudinal bore 15 in the ram it engages the front portion 17 of the plunger 16 causing the plunger to telescope rearwardly in the longitudinal bore 15 against the force of the spring 23 to the position shown in Figure 4. To adapt the ram to receive fasteners or other driven members having threaded heads smaller than the threaded portion 26 of the ram, adapters of various sizes may be screwed into the ram. The adapter 29 shown in Figure 2 has an outside threaded portion 30 receiving the threaded front end 26 of the ram and is provided with an inside diameter and thread 31 of any desired size and type to conform to the head of the selected fastener. The front end of the adapter here shown is provided with an outwardly projecting transverse flange 32 abutting against the front end of the ram. The collar is preferably provided with an edge to receive a wrench. A set screw 33 may be provided in the wall of the ram to lock the adapter in place. As shown in Figure 2 the plunger cam portion 21 is in engagement with the ball 27 and maintains the ball projecting outwardly from the rear portion 7 of the ram which engages the tool barrel bore, a sufficient distance to prevent insertion of the ram into the tool barrel bore.

Referring to Figure 4, as the driven member, in this instance a punch 34, is screwed into the ram telescoping the plunger 16 rearwardly and moving a resilient sleeve of smaller diameter than the cylindrical portion of the cam 21 into alignment with the ball 27, the ball may retract inwardly in the radial bore. In this position the ball 27 still projects from the outer surface of the ram but as the ram is inserted into the tool barrel bore 8 the ball 27 is telescoped inwardly against the resiliency of the sleeve 35. The ram 4 is thereby frictionally prevented from free sliding movement in the tool barrel bore during normal handling of the tool. The ram may thus be maintained at any desired location in the barrel relative to the longitudinal axis of the barrel bore. Another embodiment of a seal is shown in Figure 4. Here the seal 36 is a resilient ring seated in a peripheral groove in the ram. The ram seals 14 and 36 and the resilient sleeve 35 may be fabricated from any resilient material which will withstand the effects of the fluid driving medium. Materials such as neoprene or other synthetic rubbers, or elastic resinous materials are suitable.

In Figure 1 the ram 4 is shown spaced from the breech plug 3 of an explosively powered tool. When the ram 4 abuts against the breech plug 3 the fastener 5 will emerge from the tool barrel bore with the maximum force

upon discharge of any given cartridge powder charge. By positioning the ram 4 spaced from the breech plug 3 a greater expansion volume 37 for the propelling gas is provided and also the propelling gas drives the ram a shorter distance through the bore resulting in the fastener being discharged from the barrel with less force. As the space between the breech and the ram is increased the force with which the driven member is discharged from the muzzle of the bore decreases. It therefore becomes a simple matter to determine the position at which the ram should be located along the longitudinal axis of the bore for any given powder charge to discharge a given driven member with the desired force. The weight of the driven assembly will, of course, affect the force with which the fastener is driven, but since the weight of the ram greatly exceeds the weight of a fastener, a change in the fastener weight will have no appreciable effect on the force with which it is discharged from the bore. This same principle holds true for pneumatic or any other similar fluid powered tool.

The operation of the tool is as follows: With the ram 4 removed from the tool a fastener 5 or other driven element having a threaded head is screwed into the front end 26 of the ram until it abuts against the plug 18 telescoping the rear portion 22 of the plunger 16 almost against the plug 25 so that it will not be driven against the plug with any great force when the driven member engages the workpiece. The ball 27 is then in alignment with the resilient sleeve 35 and the ram is inserted into the bore 8 of the tool barrel through either the muzzle or the breech of the bore depending on the type of tool. As soon as the ball 27 engages the tool bore 8 the ram 4 will be frictionally maintained in any desired position along the longitudinal axis of the bore 8. By properly positioning the ram 4 longitudinally in the bore 8 the force with which the fastener 5 leaves the bore can be predetermined as discussed previously. The simplest and most obvious method of positioning the ram 4 is to push it through the bore 8 with a stick which may be calibrated. Depending on the type of tool and the work to be performed the tool may be equipped with a punch, cutter, fastener or some other similar driven element. In the event a punch or cutter is used it is generally merely necessary to remove the tool along with the punch or cutter from the workpiece and reposition the ram at the desired location in the tool barrel by pushing it with the aforementioned stick or rod and performing whatever other functions are inherent with the individual tool to prepare it for driving the ram.

In the event that the driving tool is used to emplace fasteners it is necessary to remove the fastener from the ram before another fastener may be driven. The muzzle end 13 of the tool barrel may be detached from the remainder of the barrel as shown in Figure 1 so that the entire ram may be removed from the bore of the tool barrel and the fastener then removed from the ram or alternatively, the front end of the ram may be provided with wrench engaging means 12 such as the hexagonal portion shown in the drawing in which event the ram is merely unscrewed from the fastener head. The punch 34 is provided with a wrench receiving headed portion 34a to facilitate its removal. It should also be noted that irrespective of the type of driven member to be used the ram may be provided with a chuck rather than with a threaded socket to receive the driven element.

It should be additionally noted that the ram may be keyed to the barrel or the barrel and ram may be of similar non-circular cross section to assure that a flat cutter blade will be discharged in proper alignment with the workpiece.

Although the ram has been described with particular reference to fluid powered tools and more particularly to pneumatic and explosively powered tools for use in conjunction with punches, cutters or fasteners, many other functions will be apparent and it is to be understood that

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the invention is not to be limited to the specific environments herein disclosed. It is also to be understood that the seal on the rear end of the ram may assume many other specific forms and that the resilient sleeve on the plunger and the seals may be fabricated of other appropriate material which will adequately bias the ball outwardly or function as a seal and which will not be adversely affected by the particular propelling fluid used in the particular tool. Although certain specific embodiments and component parts are set forth in the foregoing it will be understood that various changes may be made in such embodiments and parts without departing from the spirit and scope of this invention and this invention is not to be limited to such embodiments or such components except as set forth in the appended claims.

We claim:

1. In a tool, a ram to be received in a bore in said tool, said ram having means to operatively receive a driven element, stop means on said ram to prevent insertion of said ram into said bore when said driven element is not operatively received therein, and means actuated when said driven element is operatively received in said ram to permit said stop means to retract so as to allow said ram to be operatively received in the bore of said tool.

2. A ram for insertion into the bore of a tool barrel, said ram comprising means to receive a member to be driven through said bore, stop means to prevent insertion of said ram into said bore prior to said member being received in said ram, and means actuated when said driven element is received in said ram to permit said stop means to retract so as to allow said ram to be received in the bore of said tool.

3. In the ram of claim 2, said means to receive said member comprising a threaded socket which receives a threaded portion of said member.

4. A ram for insertion into a tool barrel bore, said ram having a longitudinal bore open at one end, receiving means in a portion of the open end of said bore to receive a driven element to be propelled through said bore, a plunger received in said longitudinal bore and normally positioned with an end projecting into said receiving means portion of said bore, said ram including stop means to prevent its insertion into said tool barrel bore when said plunger is in said normal position, said plunger being positioned inwardly with respect to said normal position in the open end of said receiving means portion of said bore when said driven element is received in said portion, and means on said plunger to permit said stop means to retract when said plunger is positioned inwardly with respect to said normal position in the receiving means portion of said bore.

5. The ram of claim 4, wherein said receiving means is threaded to receive a threaded portion of said driven element.

6. A ram for insertion into a tool, said ram comprising a body member having a longitudinal bore telescopically receiving a plunger, means normally biasing said plunger outwardly with respect to an open end portion of said bore, a transverse bore through a wall of said body member and opening into said longitudinal bore, a ball seated in said transverse bore and means on said plunger to maintain said ball rigidly positioned outwardly from the adjacent outer surface of said body portion when said plunger is in its normal position, and means to withdraw the last said means so that said ball may move inwardly in said transverse bore to allow said ram to be operatively positioned in said tool.

7. The ram of claim 6 wherein said open end portion of said bore includes means to threadably receive a member to be secured in said ram.

8. In a tool, a ram to be received in a bore in said tool, said ram comprising; means to operatively receive a driven element, positioning means to maintain said ram selectively positioned at any one of a plurality of de-

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sired locations along the longitudinal axis of said bore prior to driving said ram and said driven element through said bore when said driven element is received in said ram, stop means to prevent insertion of said ram into said bore when said driven element is not received in said ram, and means actuated when said driven element is operatively received in said ram to permit said stop means to retract so as to allow said ram to be operatively received in the bore of said tool.

9. In the tool of claim 8, said positioning means and said stop means collectively comprising a protrusion extending outwardly from said ram.

10. A ram for insertion into the bore of a tool barrel, said ram comprising; means to receive a member to be driven through said bore, stop means to prevent insertion of said ram into said bore prior to said member being received in said ram, and means actuated when said member is operatively received in said ram to permit the last said means to retract so as to allow said ram to be operatively received in the bore of said tool, and positioning means to maintain said ram selectively positioned in any one of a plurality of desired locations throughout said bore when said member is received in said ram.

11. In the tool of claim 10 said stop means and said positioning means collectively comprising a member protruding outwardly from said ram.

12. In the tool of claim 10 said receiving means threadably receiving said driven member.

13. A ram for insertion into a tool barrel bore, said ram having a longitudinal bore open at one end, receiving means in a portion of the open end of said bore to receive a driven element to be propelled through said bore, a plunger received in said longitudinal bore and normally positioned with an end projecting into said receiving means, said ram including stop means to prevent its insertion into said tool barrel bore when said plunger is in said normal position, said plunger being positioned inwardly with respect to said normal position when said driven element is received in said receiving means, and means on said plunger to permit said stop means to withdraw so as to permit said ram to be positioned in said tool barrel bore when said plunger is positioned inwardly with respect to the driven element receiving portion of said bore, and means to maintain said ram and said driven element selectively positioned throughout the length of said tool barrel bore when said driven element is received in said ram.

14. A ram for insertion into a tool, said ram comprising; a body member having a longitudinal bore telescopically receiving a plunger, means normally biasing said plunger outwardly with respect to an open end portion of said bore, a transverse bore through a wall of said body member and opening into said longitudinal bore, a member seated in said transverse bore and means on said plunger to maintain said member rigidly positioned outwardly with respect to the outer surface of said body portion when said plunger is in its normal position, means to withdraw the last said means so that said member may move inwardly in said transverse bore to allow said ram to be operatively received in said tool, and means to maintain said member resiliently positioned outwardly of the outer surface of said ram when said plunger has been displaced from said normal position whereby said member may be resiliently telescoped inwardly in said bore with respect to said surface of the ram when said plunger is moved inwardly in the ram with respect to its normal position.

15. The ram of claim 14 wherein said open end portion of said bore includes means to threadably receive a member to be secured in said ram.

16. An article of manufacture comprising a body having a socket, a plunger telescopically received in said socket and means biasing said plunger outwardly toward

the open end of said socket to a first normal position, a passageway through a wall of said body and opening into said socket and a member received in said passageway; said plunger having means to maintain said member rigidly protruding from said body when said plunger is in its normal position, said plunger further having means to maintain said member resiliently protruding outwardly from said body portion when said plunger is telescoped inwardly from its normal position with respect to the open end of said socket.

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