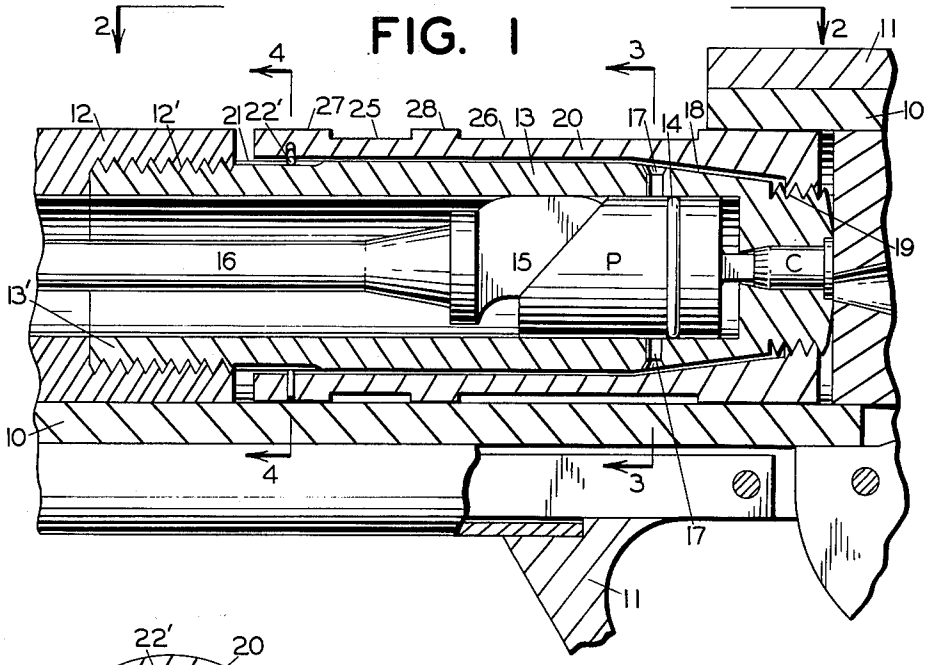
Sept. 7, 1965 R. C. KVAVLE 3,204,400

EXPLOSIVELY-ACTUATED STUD-DRIVING TOOL

Filed Nov. 26, 1963

FIG. 1



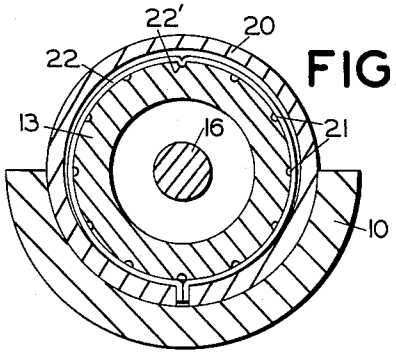


FIG. 4

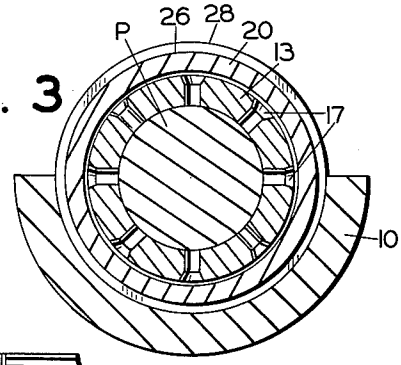


FIG. 3

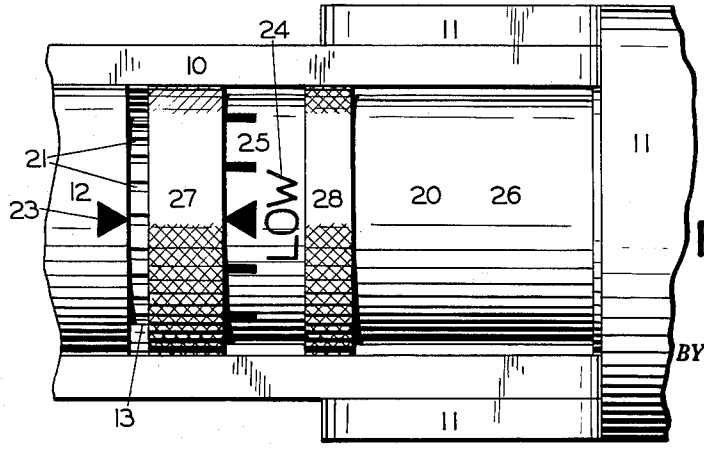


FIG. 2

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EXPLOSIVELY-ACTUATED STUD-DRIVING TOOL

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Filed Nov. 26, 1963, Ser. No. 325,951
4 Claims. (Cl. 60—26.1)

This invention, like the invention described in my pending application for patent under the same title, filed February 1, 1963, Serial No. 255,589, now U.S. Patent No. 3,168,744, relates to explosively-actuated hand tools for driving studs, pins, or similar fastening elements into hard surfaces, and the present application is a continuation-in-part of application Serial No. 255,589, to which reference should be made.

The particular object of this present invention is to provide an explosively-actuated tool, such as that described in pending application Serial No. 255,589, with additional means for adjusting the force of the explosive charge or impact delivered against the piston in the gun barrel and transmitted to the ram attached to the piston, which ram in turn drives the stud, or other fastening element, as the result of the explosive charge delivered against the piston.

The actual amount of the force of impact necessary for the desired driving of a particular stud into place depends on the nature of the surface into which the stud must be forcibly driven. Thus when such surface is softer than that on which the explosively-actuated tool is normally intended to be used, or in other words, when the explosive force produced by the firing of the cartridge in the tool is calculated to drive the stud or fastening element into a harder surface, then the use of the tool on a softer surface results in undesirable overdriving of the tool.

While the explosively-actuated tool described in pending application Serial No. 255,589 is provided with special novel means for presenting any serious damage to the tool in the event of overdriving, the present invention has a related specific object, namely to reduce the possibility of such overdriving of the tool when employed on softer surfaces.

This particular object I am able to achieve by causing some of the explosive force of the fired cartridge to be dissipated and disseminated in its impact against the piston in the gun barrel when the tool is used on softer surfaces than those on which the tool would normally be used.

The manner in which and the means by which this is accomplished, and the way in which the partial dissemination of the explosive force is adjustably controlled, will be described and explained briefly with reference to the accompanying drawings.

In the drawings:

FIG. 1 is a fragmentary sectional elevation of the tool, taken longitudinally along the approximate center or axis of the gun barrel, showing the breech end portion of the gun barrel and adjacent portion of the tool, with the tool in position ready to be fired;

FIG. 2 is a fragmentary top plan view of the same portion of the tool taken on line 2—2 of FIG. 1;

FIG. 3 is a section on line 3—3 of FIG. 1; and

FIG. 4 is a section on line 4—4 of FIG. 1.

The muzzle portion of the gun and the handle portion, together with the entire firing pin assembly, are omitted from FIG. 1 since these are the same as those of the tool of the pending application Serial No. 255,589 and do not in themselves form part of the present invention.

Referring to FIGS. 1 and 2 of the attached drawings, the tool includes the usual barrel housing **10** on the rear end of which is secured the usual handle assembly **11**. Only the forward portion of the handle assembly is shown in the drawing. In the part of the barrel housing **10**

shown in FIG. 1 where is the customary open portion in the top and side to permit access to the gun barrel, the barrel being longitudinally slidable in the housing **10** to a limited extent as usual.

The gun barrel, however, instead of consisting of a single integral member as heretofore customary, comprises a front member **12** (corresponding to the same portion of the barrel of the tool in application Serial No. 255,589), and a specially formed rear member **13**, shaped as shown in FIG. 1. The front member **12** of the composite barrel has an annular threaded recess **12'** to accommodate the corresponding externally threaded front end **13'** of the rear member **13** of the barrel, enabling the rear member **13** to be rigidly secured to the front member and to form therewith a composite gun barrel with a continuous barrel bore.

A piston P is mounted in the composite gun barrel as usual and carries a friction ring **14** on its outer surface which engages the wall of the bore of the barrel so as to prevent inadvertent sliding of the piston in the barrel. A ram having a head **15** and a shaft **16**, is removably attached to the piston P. The ram and piston are the same as those of the tool in application 255,589 and therefore need not be described here.

The rear member **13** of the composite gun barrel is provided with an aperture or chamber to accommodate the cartridge C in the usual manner, as shown in FIG. 1. The wall of this rear member **13** has an annular row of equally spaced apertures or ports **17** (FIGS. 1 and 3) positioned in the location shown in FIG. 1. Starting a slight distance ahead of this row of apertures the outer wall of the member **13**, as indicated at **18**, tapers toward the rear, terminating in a shoulder formed by a reduced diameter end **19**, which end is externally threaded.

A control sleeve **20** is rotatably mounted on the member **13** within the housing **10** and is capable of slight longitudinal or axial adjustment with respect to member **13**. The interior wall of this sleeve **20** conforms substantially to the exterior wall of member **13** which it encompasses, having a decreasing diameter portion forming a tapering interior wall corresponding to the tape of the exterior wall on the rear portion of the member **13**. The sleeve **20** also terminates in an internally threaded portion of reduced diameter which mates with the externally threaded end **19** of the member **13**.

Thus, as apparent from FIG. 1, rotation of the sleeve **20** on the member **13** will result in longitudinal or axial movement of the sleeve **20** with respect to the member **13**. Furthermore relative axial movement of the sleeve **20** with respect to member **13** in a forward direction (thus towards the left as viewed in FIG. 1), produced by rotating the sleeve **20** in one direction, will result in reducing the spacing between the opposed tapered wall portions of the sleeve **20** and member **13** until these opposed portions are brought completely together resulting in the complete closing of the outer ends of the ports or apertures **17** of member **13**, while opposite rotation of the sleeve **20** on the member **13**, causing opposite relative axial movement of the sleeve **20** with respect to member **13**, will cause the outer ends of the ports **17** to be opened to an extent depending on the amount of such relative movement.

When the outer ends of the ports **17** are partially open and the firing of the cartridge in the tool takes place, a portion of the gas of the explosion, as the piston P is thrust forwardly (thus to the left as viewed in FIG. 1) will then be able to escape through the ports **17** and thence on through the narrow space between the member **13** and sleeve **20**, instead of being confined entirely to the bore of the gun barrel behind the advancing piston as customary. This dissemination or loss of some of the explosion gas behind the advancing piston results in re-

ducing the force with which the ram, connected with the piston, is driven, and consequently reduces the force impinged upon the stud by the ram, or, in other words, reduces the force with which the stud is driven. As obvious, the greater the amount of this loss of explosion gas from the barrel behind the piston, the less will be the diving force imparted by the tool. In this way the present invention accomplishes its special object of providing against too much overdriving of the tool when the tool is used on softer surfaces.

In order to prevent inadvertent rotation of the sleeve **20** on the member **13**, a plurality of short, equally spaced, parallel, longitudinally-extending grooves **21** are provided on the outer wall of the member **13** beneath the forward end of the sleeve **20** and extending a slight distance beyond the forward end of the member **13**. A spring **22** is mounted in an annular groove on the inside wall of the sleeve **20** near the forward end and this spring has an inwardly extending portion **22'** adapted to engage the grooves **21** with sufficient spring force to hold the sleeve against inadvertent rotation while also enabling the sleeve to be rotated manually without difficulty when desired.

As a guide in the setting of the sleeve **20**, and consequently for making adjustments of the tool for use on surfaces of different hardness, cooperating indicia are placed on the outer surface of the rear end of the gun barrel portion **12**, such as the central indicator mark **23** shown in FIG. 2, and suitable registration markings and notations on the sleeve **20**, such as shown for example at **24** in FIG. 2, prefrably the latter being arranged in a shallow annular recess **25**. Also preferably the outer surface of the sleeve **20** is formed with a second annular recess **26**, resulting in rib portions **27** and **28** which preferably are knurled on their outer surface to facilitate a finger grip on the sleeve when rotation of the sleeve **20** for adjusting the driving force of the tool is required.

Obviously minor modifications could be made in the adjustable sleeve **20** and on the portion **13** of the gun barrel without departing from the principle of the invention, and it is not intended to restrict the invention to the particular form and arrangement illustrated and described or to limit the invention otherwise than as set forth in the claims.

I claim:

1. In an exposively-actuated tool of the character described including a gun barrel, a piston in the bore of the gun barrel and a cartridge aperture in the rear wall of the gun barrel, an exhaust port in the side wall of the gun barrel near the rear wall of said gun barrel, the outer peripheral wall surface of said gun barrel having a reduced diameter portion at the location of said exhaust port, means adjustably mounted on said reduced diameter portion of said gun barrel for controlling the outlet of said exhaust port, whereby the opening of the outlet of said exhaust port prior to the firing of the tool will reduce the impact delivered from said piston and thereby reduce the tendency for the tool to be overdriven when used on softer surfaces, and a housing for said gun barrel, said gun barrel and said means slidably mounted in said housing, said housing having an open portion permitting access to said means when said gun barrel is in firing position.

2. In an explosively-actuated tool of the character described including a gun barrel, a piston in the bore of the gun barrel and a cartridge aperture in the rear wall of the gun barrel, a plurality of exhaust ports in the side wall of the gun barrel near the rear wall, said exhaust ports positioned at equally spaced distances in an annular row on the side wall of said gun barrel, the outer peripheral wall surface of said gun barrel being of reduced diameter at said exhaust ports and having a frusto-conical portion at said ports tapering towards the rear end, an adjusting sleeve on said gun barrel extending over said ports, said sleeve having a tapering inside wall corresponding to said frusto-conical portion of said peripheral wall surface of said gun barrel, whereby movement of said sleeve in an axial direction with respect to said gun barrel will control the outlets of said exhaust ports, means for adjusting said sleeve in an axial direction on said gun barrel, whereby the opening of the outlets of said exhaust ports prior to the firing of the tool will reduce the impact delivered from said piston and thereby reduce the tendency for the tool to be overdriven when used on softer surfaces, and a housing for said gun barrel, said gun barrel and said sleeve slidably mounted in said housing, said housing having an open portion permitting access to said sleeve when said gun barrel is in firing position.

3. In an explosively-actuated tool of the character described, a composite gun barrel comprising a forward member and a rear member rigidly secured together, a piston in the bore of said composite barrel, said rear member having a rear wall and a cartridge aperture in said rear wall, a plurality of exhaust ports in the side wall of said rear member near said rear wall, the outer peripheral wall surface of said rear member having a smaller daimeter than the main outer peripheral wall surface of said forward member and having a frusto-conical portion at said ports tapering towards the rear end, an adjusting sleeve rotatably mounted on said rear member and extending over said ports, said sleeve having a tapering inside wall corresponding to said frusto-conical portion of said peripheral wall surface of said rear member, whereby axial movement of said sleeve with respect to said rear member will control the outlets of said ports, said sleeve and said rear member having threaded engaging portions so arranged that rotation of said sleeve on said rear member will cause adjustment of said sleeve in an axial direction on said rear member, whereby the opening of the outlets of said ports prior to the firing of the tool will reduce the impact delivered from said piston and thereby reduce the tendency for the tool to be overdriven when used on softer surfaces, and a housing for said composite gun barrel, said composite gun barrel and said sleeve slidable in said housing, said housing having an open portion permitting access to said sleeve when said composite gun barrel is in firing position.

4. The combination set forth in claim **3** with the addition of means for preventing inadvertent rotation of said sleeve on said composite gun barrel and means for indicating the relative adjusted position of said sleeve.

No references cited.

MARK NEWMAN, *Primary Examiner.*