FIG. 1 is a view illustrating the combination of the tool with the fastener guide with the connecting means interposed between the fastener guide and the barrel to limit forward motion of the barrel with respect to the guide. More particularly, the connecting means is preferably arranged so that a piston carried in the bore of the barrel, and normally engaging a fastener located in the fastener guide upon forward motion of the barrel with respect to the fastener guide, is prevented from engaging a partially driven fastener upon forward motion of the barrel with respect to the fastener guide when the connecting means is interposed. Other advantageous features of the invention include a bayonet mounting of the barrel in its housing and friction retention of a fastener in the fastener guide.

Further objects and advantages of the invention will be apparent from a reading of the following description in connection with the accompanying drawings, in which:

FIG. 2 is an enlarged cross-sectional view taken along the line 2—2 of FIG. 1 and looking in the direction of the arrows;
On the outside of the barrel housing 28, an interlock housing 36 is mounted by two screws 37 and 38, the transverse slot 13 being formed in this member to receive the pin 12. Within the interlock housing, an interlock member 39 is supported for lateral motion between a normal, radially outward position, shown in FIG. 1, and a depressed, radially inward position shown in FIG. 3 and illustrated in dotted outline in FIG. 4, and a depressed, radially inward position shown in FIG. 3 and illustrated in full in FIG. 4. As best seen in FIGS. 1 and 3, the member 39 comprises an actuating button 40, which projects outwardly through an elongated aperture 41 in the outer housing 36 of the spring retainer body 42 which is elongated in the direction parallel to the tool axis and is located within the interlock housing 36, and an inwardly projecting pin 43, extending through an elongated aperture 44 in the barrel housing 28. Two compression springs 45 and 46, disposed in corresponding recesses in the spring retainer body 42, engage the inner surface of the barrel housing 28 and urge the member 39 toward the normal position shown in FIG. 1.

Inside the barrel housing 28 a connecting bar 47, which has an inwardly enlarged head portion 48 arranged to abut the shoulder 26 of the barrel block 27 extends longitudinally along the inner housing surface toward the forward end of the tool, passing between the barrel housing and the annular shoulder 19 at the rear end of the guide housing 16. Midway along its length, the connecting bar 47 has an aperture 48 through which the pin 43 projects inwardly in both the depressed and the normal condition of the interlock member 39. Accordingly, when the interlock member 39 is in its normal outward position, the barrel 25 is permitted to slide forwardly the maximum amount with respect to the fastener guide 16 and, as will be explained hereinafter, the tool is cocked through the linkage of the fastener guide 16, the piston extension 32, the piston 39 and the barrel block 27, requiring the piston extension 32 to be in abutting relation to the fastener 22. If the barrel is moved forwardly with the interlock button 40 depressed, however, interlock pin 43 engages the fastener guide shoulder 19 before the piston extension 32 abuts the fastener 22, so that, as explained hereinafter, cocking of the tool is accomplished through the linkage of the fastener guide 16, the interlock pin 43, the connecting bar 47 and the barrel block 27, permitting the piston extension 32 to remain spaced from the fastener 22 as illustrated in FIG. 3.

Previously mentioned, the barrel block 27 is retained in the barrel housing 28 by a bayonet-type connection which facilitates assembly and disassembly. As best seen in the cross-sectional view of FIG. 2, three lugs 50, 51 and 52 project outwardly from the periphery of the barrel block 27 and three corresponding lugs 53, 54 and 55 extend inwardly from the inner surface of the barrel housing 28. In the assembled position illustrated in the drawings, the barrel block lugs are disposed forwardly of the housing lugs so that the barrel cannot be withdrawn from the housing without relative rotation. To prevent such rotation from occurring inadvertently, a longitudinal slot 56 is cut into the lower side of the barrel block and a set screw 57, threaded into the housing 28 and extending into a recess within the interlock housing 36, has a tip 58 which is movable selectively into or out of the slot 56 upon rotation of the screw in the appropriate direction. To permit rotation of the set screw without disassembling the interlock assembly, an aperture 59 is provided in the interlock housing and another aperture 60 in the handle assembly may be aligned with the aperture 59 when the pin 12 is at the rear of the slot 13. To remove the barrel from its housing, therefore, it is only necessary to retract the set screw 57 in its recess and rotate the barrel block 27 approximately one-third of a turn. As soon as the lugs 50, 51 and 52 are disengaged from the housing lugs 53, 54 and 55, the spring 24 will force the barrel rearwardly out of its housing.

In the handle and breech block assembly 10, a handle 65 has a forward trigger guard extension 66 in which the transverse pin 12 is mounted and a longitudinal slot 67 in this extension receives the interlock housing 36 for longitudinal sliding motion during relative motion of the handle and barrel assemblies. In addition, a trigger 68 mounted by a screw 69 in the handle 65 and is pressed parallel to the axis of the tool is urged toward a forward position in the slot by a compression spring 70. An inclined cam surface 71 at the top rear of the trigger 68 engages a corresponding inclined surface 72 on a sear actuator 73 which is supported in the slot 69 for sliding motion parallel to the axis of the tool. When the handle 65 is depressed downwardly against the surface 71 by a compression spring 74 extending between the sear actuator and a cylindrical breech block housing 75. As a result, a projection 76 on the sear actuator is forced forwardly toward the axis of the tool through an opening 77 in the breech block housing so as to project inside the housing upon rearward motion of the trigger 68, the spring 74 restoring the actuator and the trigger when the trigger is released.

Inside the breech block housing 75, which projects forwardly far enough to enclose the rear end of the barrel block in the uncocked position shown in FIG. 1, a breech block 78 is held in fixed position by a screw 79 which, the breech block and housing also being affixed to the handle 65 by a screw 80. A firing pin 81 slidably mounted in a bore 82 in the breech block and urged forwardly therein by a firing pin spring 83 has a forward control extension 84 which normally fits into a corresponding opening in the front wall of the breech block so that the tip projects through the opening in line with the rim of a cartridge 86, inserted in the cartridge chamber 61 of the barrel block 27, when the firing pin is in its forward position in the bore 82, as shown in FIG. 1. Projecting laterally from one side of the firing pin 81 and extending part way into a longitudinal slot 85 in the breech block is a pin 86 fitting loosely in and normally extending part way into a recess 87 at one side of a sear element 88 which is longitudinally slidable in the slot 85. The loose connection between the pin 86 and the sear element 88 permits a rocking motion of the sear element in the slot 85 about the adjacent forward edge of the firing pin in a plane extending through the axis of the tool and a spring 89 extending between the sear element and the firing pin normally presses a beveled surface 90 at the rear end of the sear against the housing 75 so as to deflect the forward end 91 of the sear toward the axis of the tool.

As shown in the drawings, the forward tip 91 of the sear element normally projects forwardly from the breech block and, in the tilted position of the sear element aligned with a surface portion 92 of the rear wall of the barrel block 27, the surface 92 being angled inwardly so as to retain the tip 91 in place when longitudinal pressure is applied by the barrel block to the sear element. Immediately adjacent to the surface portion 92 and in line with the breech block slot 85 is a recess 93 into which the forward end of the sear may be received when the sear is rocked about the adjacent forward edge of the firing pin to tilt the rear end away from the housing.

The breech block also includes a plunger 94 slidable in a bore 95 and pressed forwardly therein by a spring 96 so as to project from the breech block against the rear surface of the barrel block and, in the uncocked position of the tool shown in FIG. 1, this holds the barrel block away from the front end of the breech block. By changing the strength of the spring 96, the pressure necessary to cock the tool can be adjusted without requiring any change in the strength of the firing pin spring 83.

In order to prevent inadvertent firing of the tool without operation of the trigger 68 as, for example, by dropping the tool when loaded, the tool includes a safety arrangement which prevents rocking of the sear lever
88 so as to disengage the surface 92 of the barrel block 27 unless the trigger is operated. This arrangement comprises a triangular block 97 located in the trigger slot 69 above the trigger 65 and at its forward end. The block 97 has an inclined surface 98 in engagement with a corresponding inclined surface 99 on the trigger so that the block cannot move downwardly, as viewed in the drawings, unless the trigger 68 has been pulled to the rear. At the top of the block 97, a projection 100 extends through an opening in the breech block housing 75 to engage the bottom surface of the forward end 91 of the rear barrel 75, thereby preventing disengagement thereof from the surface 92. When the trigger 68 is operated, the projection 100 recedes and disengagement is permitted.

In operation, the barrel assembly is moved forwardly to disengage the barrel block 27 from the forward end of the breech block housing 75 and is then pivoted about the pin 12 to expose the breech end of the barrel. After a cartridge 60 has been inserted in the chamber 61, the barrel assembly is pivoted back to aligned position and moved rearwardly into the breech block housing until the barrel block 27 engages the plunger 94, as shown in FIG. 1. Also, a fastener 22 is driven into the fastener guide 17 so as to be releasably retained therein by the engaging edge 23a of the retaining 23.

In an initial driving operation, the forward end of the tool is placed against a workpiece at the location of fastener insertion and the handle and breech block assembly 10 is pressed toward the workpiece. This motion forces the barrel assembly 11 forwardly until the piston 30 abuts the rear end of the bore 31 in the barrel block 27 and the piston rod 32 engages the rear end of the fastener 22, the forward end thereof being pressed against the workpiece. During this motion, the barrel 25 slides forwardly inside the fastener guide housing 16 and around the fastener guide 17 against the pressure of the spring 24 to an extent dependent upon the length of the fastener 22. After the piston extension 32 has engaged the fastener 22 and the barrel block 27 has engaged the piston 30, those elements can no longer move forwardly.

In this addition, the handle and breech block assembly 10 is moved forwardly with respect to the barrel assembly 11 by the spring 24, held in engagement with the surface portion 92 by the spring 89, acting through the pin 86, retains the firing pin 81 in a fixed position with respect to the barrel assembly as the breech block moves rearwardly, thereby cocking the firing pin 83. Likewise, the plunger 94 is held in position against the barrel block 27 so that the plunger spring 96 is compressed, adding to the force required to move the breech block to the cocked position. At the same time, the projection 76 of the rear actuator 73 is moved forwardly to a location beneath the rear end of the rear element 88.

To fire the cartridge, the trigger 68 is moved rearwardly, lowering the block 97 to permit the rear projection 91 to disengage the surface 92 of the barrel block 27 and, at the same time, raising the rear actuator 73 so that the projection 76 rocks the rear element about the adjacent forward edge of the firing pin 81 and the forward tip 91 of the rear is disengaged from the surface 92. This permits the firing pin spring 83 to drive the firing pin 81 forwardly to fire the cartridge 60 and, during that operation, the rear element 88, being aligned with the recess 93 in the barrel block, is moved forwardly into the breech block housing 75. Upon detonation of the cartridge 60, the piston 30 and the piston rod 32 are driven forwardly to drive the fastener 22 into the workpiece, firm contact being maintained between the piston rod and the fastener during driving.

When the piston has moved forward far enough to uncover the exhaust ports 31a, the explosion gases are vented to the atmosphere through the housing 28 and the exhaust passages 15a, but the momentum imparted to the piston, piston rod and fastener are usually great enough to assure that the fastener is driven into the workpiece until the enlarged head at the rearward end of the fastener comes up against the disc 21 and the workpiece. In this condition, the forward end of the piston is spaced from the rear end of the fastener 17 by a distance greater than the length of the buffer 35 so that there is normally no impact between the elements. If, however, there is insufficient resistance in the workpiece to stop the fastener when the enlarged head engages the disc 21 against the workpiece, the piston 30 will merely come into contact with the relatively maliable buffer 35 so that the driving energy of the piston is dissipated by deformation of the buffer without damage to the other components of the tool and without imparting additional driving energy to the fastener 22. In this event, the deformed buffer 35 may be removed and replaced by a new buffer.

Should the trigger 68 be pulled rearwardly prior to cocking of the tool, the projection 76 on the rear actuator 73 is moved inwardly into the recess 85 so as to block the rearward movement of the rear 88 and cocking and firing of the tool 22 thereby prevented. The operator is thus forced to follow the proper sequence in using the tool, and cannot simply push to fire.

If the resistance of the material into which the fastener is being driven is high enough to prevent the fastener from being driven completely home, the fastener 22 and the piston extension 32 and piston 30 will be in positions such as shown in FIG. 1 at the completion of the initial driving operation. Inasmuch as the forward pressure applied by the operator on the handle assembly 10 and the barrel block 27 is maintained during driving, the barrel block 27 will be moved forwardly until it abuts the piston 30 after the explosion gases have been exhausted, as illustrated in FIG. 1, and the piston 30 will thereafter be retained in its rearmost position in the barrel 25 by the friction plunger 33. As the handle assembly is withdrawn away from the workpiece after firing, the forward end 91 of the rear 88 will be withdrawn from the recess 93 and it will be restored to its normal position against the surface 92, as shown in FIG. 1.

To reset the partially driven fastener 22, the tool is withdrawn from the workpiece and before reloading, a ramrod is preferably pushed into the barrel bore from the muzzle end of the tool 22 to make certain that the piston is fully back to its rearmost position. Thereafter, the tool is reloaded and, with the button 40 of the interlock member 39 depressed as shown in FIG. 3, the tool is again placed over the fastener and the holder assembly 10 is moved forwardly as far as it will go. In this condition, the pin 43 of the interlock member is moved forwardly until it abuts the shoulder 19 of the fastener guide housing 16 and the head 48 of the connecting bar 47 abuts the shoulder 26 of the barrel block 27, thereby preventing the piston extension 32 from engaging the fastener 22. Further forward motion of the handle assembly 10 with the forward end 91 of the rear 88 engaging the surface 92 serves to cock the tool in the manner previously described.

When the trigger 68 is actuated in this condition, the piston 30 and its extension 32 are driven forwardly without resistance until the gap between the piston extension and the fastener is closed, at which point the momentum of the piston is transferred to the fastener along with forward energy of the continued driving force of the explosion gases. Inasmuch as the piston has been driven forwardly from the rear of the barrel 25 a considerable distance, however, if high resistance to driving of the fastener is again encountered, the expanding gases can escape through the ports 31a without imparting any ex-
cessive recoil to the barrel block and the handle assembly.

Although the invention has been described herein with reference to a specific embodiment, many modifications and variations therein will readily occur to those skilled in the art. Accordingly, all such variations and modifications are within the intended scope of the invention as defined by the following claims.

We claim:
1. A fastener driving tool comprising barrel means having a bore and having a breech end and a forward end, fastener guide means for receiving a fastener to be driven and supported at the forward end of the barrel means for longitudinal motion with respect thereto, piston means slidably supported in the bore of the barrel means and extending forwardly into the fastener guide means, cartridge receiving means at the breech end of the barrel means communicating with the bore of the barrel means, breech block means longitudinally movable with respect to the barrel means between a position longitudinally spaced from the breech end of the barrel means and a forward position abutting the breech end of the barrel means, firing pin means slidably supported in the breech block means and urged forwardly therein toward a cartridge firing position, rear means normally interposed between the firing pin means and the barrel means to prevent forward motion of the firing pin means as the breech block means is moved toward its forward position, trigger means arranged to displaced the rear means from interposed relation when the breech block means is in its forward position, thereby permitting the firing pin to move forwardly to the cartridge firing position, and interlock means for selectively restricting forward motion of the barrel means with respect to the fastener guide means.

2. A fastener driving tool including barrel means having a bore and having a breech end and a forward end, fastener guide means supported at the forward end of the barrel means for longitudinal motion with respect thereto and having a bore of smaller diameter than the bore of the barrel means and coaxial therewith for receiving a fastener to be driven and piston means for driving a fastener received in the bore of the guide means comprising a large diameter rearward portion fitting closely into the bore of the barrel means and a smaller diameter forward portion extending into the bore of the fastener guide means for driving engagement with a fastener to be driven, interlock means for selectively restricting forward motion of the barrel means with respect to the fastener guide means.

3. A fastener driving tool according to claim 1 wherein the interlock means comprises connecting means operatively interposed between the barrel means and the fastener guide means including a member selectively movable into and out of blocking relationship with respect to a rearwardly facing portion of the fastener guide means.

4. A fastener driving tool according to claim 1 wherein the piston means includes a laterally movable element and means for urging the element outwardly to provide frictional engagement with the bore of the barrel means.

5. A fastener driving tool according to claim 1 including fastener retaining means in the fastener guide means having a surface extending generally parallel to the axis of the barrel, and means for urging the surface of the fastener retaining means inwardly toward the bore axis.

6. A fastener driving tool comprising barrel means having a bore and having a breech end and a forward end, fastener guide means for receiving a fastener to be driven and supported at the forward end of the barrel means for longitudinal motion with respect thereto, piston means slidably supported in the bore of the barrel means and extending forwardly into the fastener guide means, cartridge receiving means at the breech end of the barrel means communicating with the bore of the barrel means, breech block means longitudinally movable with respect to the barrel means between a position longitudinally spaced from the breech end of the barrel means and a forward position abutting the breech end of the barrel means, firing pin means slidably supported in the breech block means and urged forwardly therein toward a cartridge firing position, rear means normally interposed between the firing pin means and the barrel means to prevent forward motion of the firing pin means as the breech block means is moved toward its forward position, trigger means arranged to displaced the rear means from interposed relation when the breech block means is in its forward position, thereby permitting the firing pin to move forwardly to the cartridge firing position, and interlock means for selectively restricting forward motion of the barrel means with respect to the fastener guide means.

7. In a fastener driving tool including barrel means having a bore and having a breech end and a forward end, fastener guide means supported at the forward end of the barrel means for longitudinal motion with respect thereto and having a bore of smaller diameter than the bore of the barrel means and coaxial therewith for receiving a fastener to be driven and piston means for driving a fastener received in the bore of the guide means comprising a large diameter rearward portion fitting closely into the bore of the barrel means and a smaller diameter forward portion extending into the bore of the fastener guide means for driving engagement with a fastener to be driven, interlock means for selectively restricting forward motion of the barrel means with respect to the fastener guide means.

8. A fastener driving tool according to claim 7 wherein the interlock means comprises an outwardly biased inwardly depressible member supported on a housing surrounding the barrel means and engageable with the rear end of the fastener guide means upon inward depression.

9. A fastener driving tool according to claim 8 including connecting bar means extending between the depressible member and a forwardly facing abutment on the barrel means.

10. In a fastener driving tool including a barrel member having a bore and a barrel block at the rear end of the bore, a housing member for receiving the barrel member, and spring means operably associated with the housing member for the barrel member and urging the barrel member rearwardly with respect to the housing member, bayonet connecting means on the barrel member and the housing member releasably retaining the members together against the pressure of the spring means, and lock means for releasably preventing disengagement of the bayonet connecting means.

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