

Aug. 25, 1964

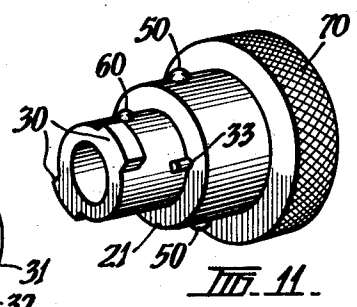
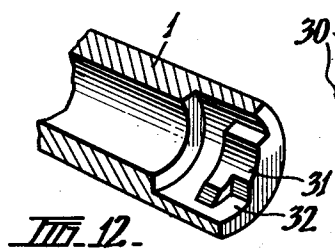
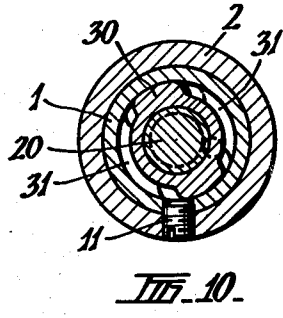
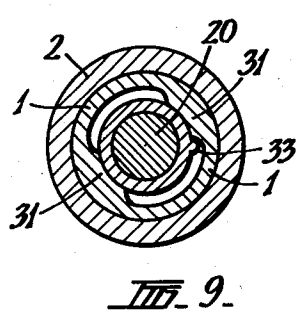
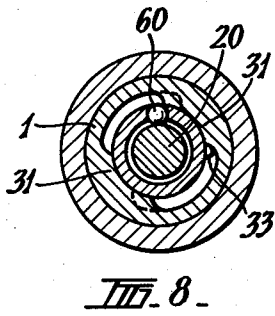
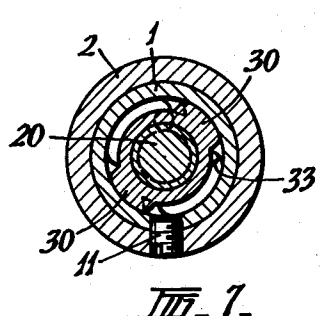
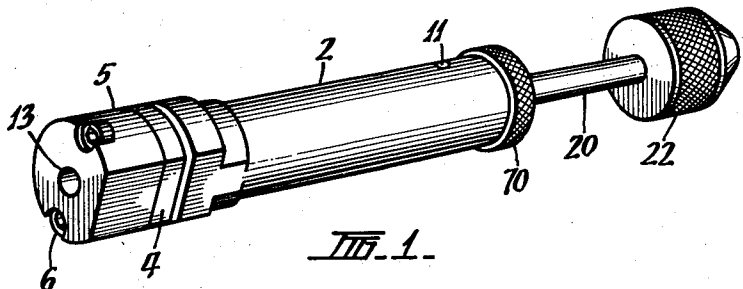
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3,145,387

EXPLOSIVE POWER ASSISTED HAMMER DRIVEN TOOL

Filed Nov. 24, 1959

3 Sheets-Sheet 1



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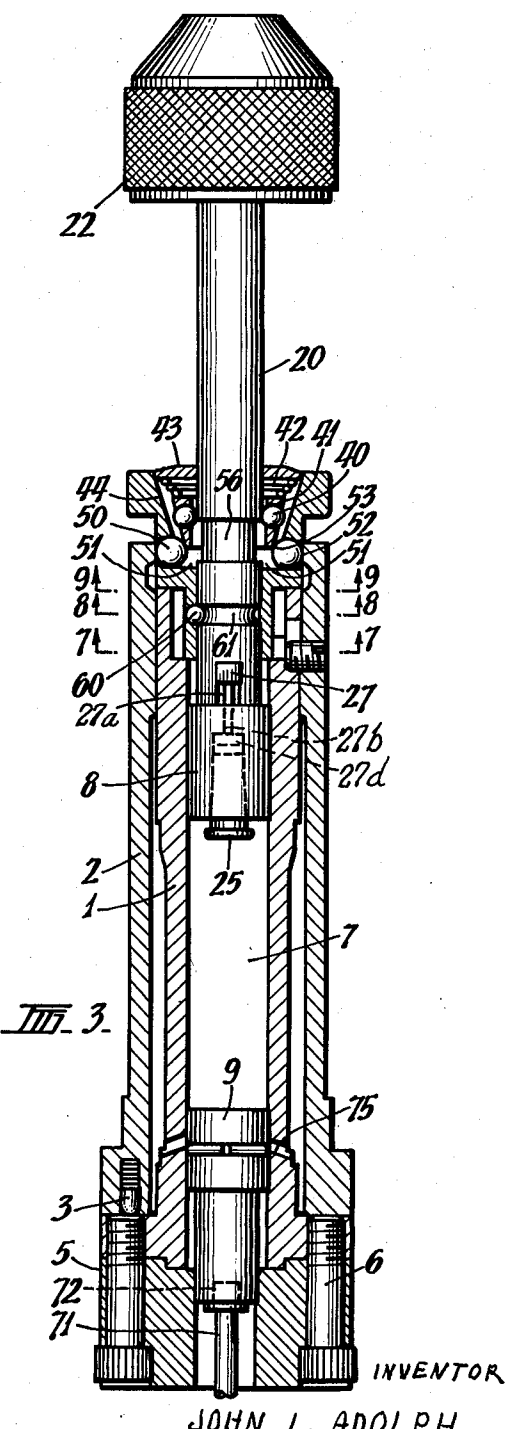
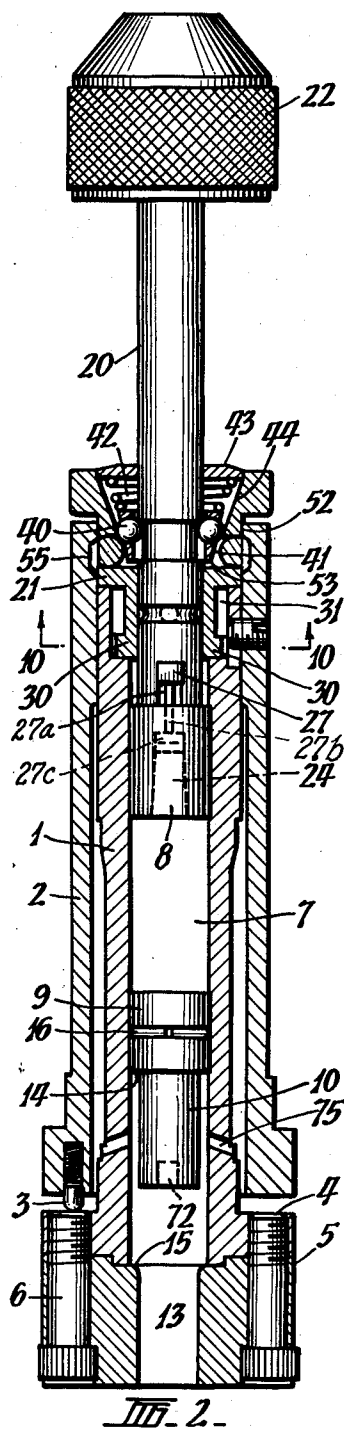
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EXPLOSIVE POWER ASSISTED HAMMER DRIVEN TOOL

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3 Sheets-Sheet 2



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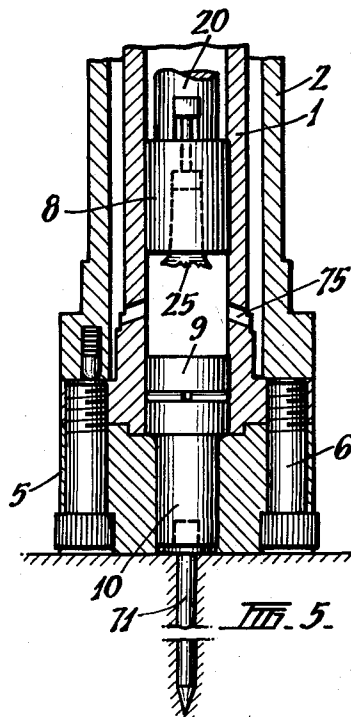
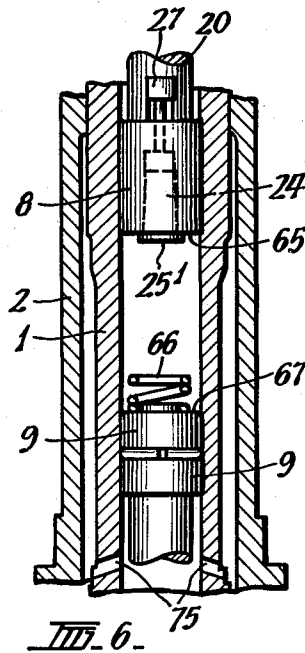
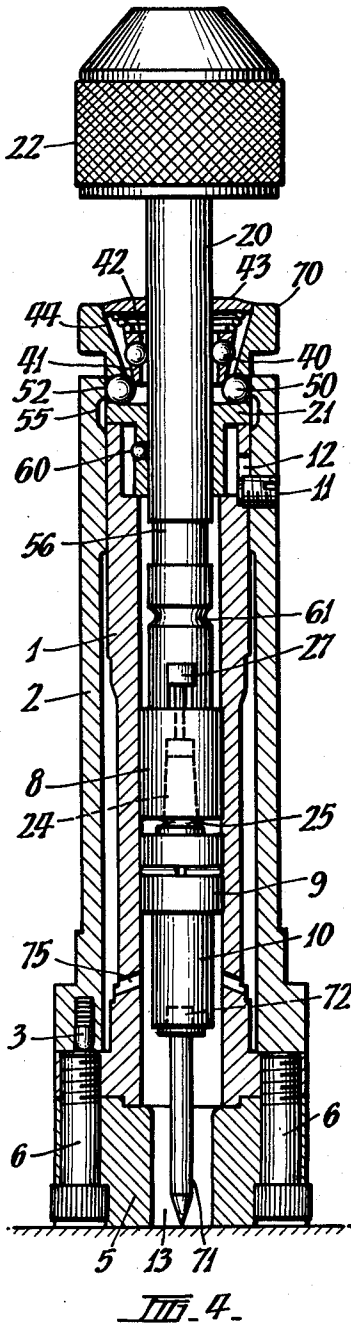
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EXPLOSIVE POWER ASSISTED HAMMER DRIVEN TOOL

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3 Sheets-Sheet 3



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3,145,387

EXPLOSIVE POWER ASSISTED HAMMER DRIVEN TOOL

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13 Claims. (Cl. 1—44.5)

This invention relates to an explosive power assisted, hammer driven tool for driving an element such as a nail, pin, stud or the like into relatively rigid material.

Explosive power operated tools, or "powder-powered" tools as they are called in the trade, are well known and, briefly stated, operate by the firing of an explosive cartridge which propels the pin, stud or like element directly along a barrel in the manner of a gun firing a bullet. The element thus has "free flight" like a projectile and, if not opposed, would travel far and with considerable force.

This potential danger is, of course, guarded against by a combination of safety devices in conventional powder-powered tools, but despite these precautions accidental firing of such tools has occurred with disastrous results.

A further and perhaps more subtle danger in the application of these tools resides in the fact that they are designed essentially to drive elements such as pins, studs, etc. into extremely resistant substances such as steel, bricks, concrete, and the like and if applied to softer materials, such as wood for instance, a legitimate firing would take place but the element could, through lack of sufficient resistance, pass completely through the material and continue upon its free flight to do unintentional and possible serious damage.

It is a primary object of the present invention to overcome the abovementioned dangers and disadvantages by providing an absolutely safe explosive power assisted tool having means which will render the tool "safe" in all positions and under all circumstances so as to make it completely "foolproof," and which, in operation, must first be initiated by a manually controlled hammer driven action, and second applies the explosive power to the element through a controlled intermediary means, such as a captive bolt or drive plunger, or the like, having limited outwardly directed travel.

It is a further object of the invention to provide such a tool that will drive a selected element substantially the same predetermined distance into any material, irrespective of its hardness or resistance to penetration, e.g. into steel, brick, concrete, wood, plaster, pulp-board, etc. using a cartridge of uniform explosive charge.

A still further object is to provide such a tool in which the element has no "free flight," i.e. is not projected like a bullet or projectile from a barrel with the propellant charge immediately behind it so that it continues to travel at high velocity if not obstructed. In a tool according to the invention, if the cartridge is accidentally fired, and there is no resistance whatever to the element, the latter will travel a distance determined by its own momentum which, being very light, is a matter of a few feet only and consequently has no destructive force.

Furthermore, the invention contemplates a tool of the type specified in which the insertion of elements of different lengths automatically provides for the driving of said elements into the material a distance corresponding to their length, without other adjustment of the tool and without requiring variation in the cartridge charge.

The explosive power assisted hammer driven tool according to the present invention, comprises a body having a cylindrical bore therethrough, with a cartridge plunger and a drive plunger slidably mounted in said bore and

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adapted for independent reciprocating movement therein. One end of the cartridge plunger extends out of one end of the bore and is adapted to be hammer driven toward the drive plunger. The other end of the cartridge plunger has a cartridge holding means therein for holding a cartridge disposed with the detonator end thereof opposed to said drive plunger. The drive plunger is moveable toward the other end of the bore for only a limited distance, and it has an abutting surface at the one end thereof opposed to the cartridge plunger so that when the cartridge makes percussive contact with detonator end on the abutting surface, the cartridge will be fired. The other end of the drive plunger is adapted to operatively engage the element which is to be driven. Yieldable means which normally separate the cartridge plunger and the drive plunger are provided, so that when an element is operatively engaged by the drive plunger and it is disposed against the work piece into which it is to be driven, when the cartridge plunger is hammer driven with sufficient force to compress the yieldable means and cause the cartridge to come into percussive contact with the abutting surface, the explosive charge will be detonated and drive the plunger for the extent of its limited movement. The element is thereby forced into the material a distance substantially corresponding to the limited movement of the drive plunger.

It will be understood by those skilled in the art that the present invention as above defined utilises a two-stage process, the first stage being manually initiated and could take the form of a blow with a hand hammer upon the outwardly directed end of the cartridge plunger.

The second stage, once having been initiated by the first stage, is mechanically controlled by two predetermined factors:

(a) The explosive charge employed, which determines the magnitude of the power assistance in driving the element, and

(b) The length of travel of the drive plunger in the bore before it reaches the limit of its outwardly directed movement, which determines the distance the element is driven into the material.

A firing charge is thus operable to overcome whatever resistance is offered to the element, be that resistance constituted by steel or pulp-board; if the resistance is relatively slight, or nil, there will be more energy left in the explosive charge at the end of the travel of the drive plunger than would be the case if it has been expended in forcing the element through a steel girder, for instance, but no further work can be done upon the element once the drive plunger has reached the limit of its travel.

Any further flight of the element would be due solely to its inertia which on account of its lightness would be very small.

It is a feature of the invention that standard elements and cartridges, as used in conventional powder-powered tools, may be employed in a power assisted tool according to this invention.

Practical arrangements of the invention will now be described with reference to the accompanying drawings, in which:

FIGURE 1 is a perspective view of the assembled tool according to the invention.

FIGURE 2 is a sectional elevation of the tool showing the breech block in the position for insertion into or extraction from the body.

FIGURE 3 is a sectional elevation of the tool showing an element inserted in the drive plunger. The breech block and sleeve are shown in the position for free inward movement of the cartridge plunger.

FIGURE 4 is a similar view to FIGURE 3 but with the element against the workpiece, thereby positioning the drive plunger and the cartridge plunger in operative posi-

tion. The figure shows the cartridge partly collapsed as a result of a hammer blow applied to the tool.

FIGURE 5 is a sectional elevation of the relevant part of the tool, showing the exploded cartridge end and the element driven into the workpiece by the explosive power assisted drive plunger.

FIGURE 6 is a sectional elevation of part of the tool, showing a modification of the invention employing a coil spring between the drive plunger and the cartridge plunger.

FIGURE 7 is a cross section on the line 7—7 of FIGURE 3, in which the breech block is in operative position.

FIGURE 8 is a cross section on the line 8—8 of FIGURE 3.

FIGURE 9 is a cross section on the line 9—9 of FIGURE 3.

FIGURE 10 is a cross section on the line 10—10 of FIGURE 2, in which the breech block is in the inserting and extracting position.

FIGURE 11 is a perspective view of the breech block, shown removed from the tool and dismantled from the cartridge plunger for clarity.

FIGURE 12 is a fragmentary perspective view of part of the end of the body showing one of the inwardly directed abutments engageable by the lugs on the breech block.

Referring to FIGURES 1 to 5, the body 1 has a sleeve 2 reciprocally mounted thereon and biased in a direction away from the workpiece by a spring loaded pin 3 acting against a flanged end 4 of the body 1, to which flanged end 4 a guide head is rigidly secured, preferably by removable machine screws 6.

The sleeve 2 is demountably secured to the body 1, and its reciprocation provided for, by means of a grub-screw 11 co-operating with a slot 12.

The body 1 has a cylindrical bore 7 in which a cartridge plunger comprising a piston member 8 and stem 20 and a drive plunger 9 are mounted for independent reciprocating movement. The drive plunger 9 is formed as a stepped piston having a portion of smaller diameter 10 adapted to slide through a concentric bore 13 in the guide head 5.

The shoulder 14 on the plunger 9 is thus in opposed relation to a corresponding shoulder 15 forming an abutment in the guide head 5, which limits the outwardly directed movement of the drive plunger 9. The drive plunger 9 may be fitted with a piston ring 16 or the like, to improve gas tightness if required.

The cartridge plunger stem 20 is preferably of reduced diameter, and passes through the breech block 21, in which are located safety devices, later herein to be described, the stem 20 being provided at its outwardly directed end with a counter-weight head 22, adapted to be struck by a hand hammer.

The inwardly directed end of the cartridge plunger piston 8, has an axial hole 24 for the reception of a cartridge 25, the hole 24 being adapted to the length of the cartridge and preferably slightly tapered as shown to facilitate the removal of the cartridge.

A cartridge extracting device 27 may be incorporated to aid in ejecting the cartridge case when the cartridge plunger stem 20 is fully extended.

This device comprises a transverse member 27 slidably mounted in a slot 27a, said member being of length in the transverse direction greater than the diameter of the stem 20 but less than the bore 7 and having an axial extension 27b reciprocable in an axial bore connecting the slot 27a and a prolongation 27c of the cartridge hole 24. Preferably the extension 27b has a head 27d adapted to engage the cartridge and extract it upon the member 27 being struck against the breech block 21 by a prolonged outward movement of the stem 20.

The breech block 21 is adapted for quick insertion and extraction with respect to the body 1 by means of two

outwardly extending radial lugs 30 on the breech block (FIGURES 7, 10 and 11) which lugs co-operate with two inwardly extending abutments 31 upon the inner circumference of a counter-bore at the corresponding end of the body (FIGURE 12 for detail), the spaces between the lugs 30 and the abutments 31 being proportioned to allow the insertion of the breech block end into the body end until the lugs 30 pass between and beyond the abutments 31, as shown in FIGURES 2 and 10, when a turning movement of the breech block relative to the body will bring the lugs 30 into register with the abutments 31, as shown in FIGURES 3, 4 and 7, thus securing the breech block in the operative position.

Stop means in the form of a pin 33, best seen in FIGURE 11, which co-acts with either of the abutments 31, arrests the turning movement of the breech block 21 when the lugs 30 are in correct register with the abutments 31. The abutments 31 may be cut away as at 32 (FIGURE 12) to give clearance for the pin 33.

For safety in handling the tool the cartridge plunger stem 20 co-acts with a blocking means disposed in the breech block 21, consisting of one or more balls 40 supported loosely in a cage 41, the latter being biased axially in an inward direction by a spring 42 which at its opposite end is retained by the permanent closure 43. The interior of the breech block in this region is formed as a tapered bore 44, the direction of the taper being such that the balls 40 are normally wedged by the spring 42 between the tapered bore 44 and the stem 20, thereby preventing inward movement of the cartridge plunger until deliberately released. Outward movement of the cartridge plunger may, however, take place as this will tend to roll the balls 40 away from the direction of taper, thereby releasing the stem 20.

To release the blocking means and free the stem 20 for inward movement of the cartridge plunger piston 8, the sleeve 2 is adapted at its breech block end to unwedge the balls 40 when the said sleeve is stressed towards the guide head 5 sufficiently to bring it into contact with the flanged end 4 of the body 1 as shown in FIGURES 3, 4 and 5.

This unwedging is conveniently effected by means of two diametrically opposed balls 50, captively mounted for free lateral movement in respective radial passages 51 and operable by an internal annular cam 52 at the corresponding end of the sleeve 2, so that upon appropriate axial movement of said sleeve the balls 50 co-act with a chamfer 53 on the cage 41 to move the latter (and the balls 40 therewith) axially away from the taper 44, compressing the spring 42 and thereby releasing the cartridge plunger 8 for free reciprocating movement. This position is shown in FIGURES 3 and 4.

The annular cam 52 is conveniently defined in the interior circumferential surface of the sleeve 2 by a relief in the form of an annular recess 55, affording lateral freedom to the balls 50 when the sleeve 2 is in the "safe" position as shown in FIGURE 2. To accentuate the locking effect of the balls 40 upon the stem 20 in this position, the stem 20 may be slightly reduced in diameter, or waisted, as at 56.

The waist 56 may be of such reduced diameter that the stem 20 is free to be reciprocated when in this position for an axial distance determined by the width of the waist 56, which limited axial freedom is advantageous when inserting and extracting cartridges, without departing from the safety provision above described, since the breech block 21 is at such times removed from the body 1 and there is then no easy way of releasing the blocking means. The limited axial freedom afforded by the waist 56 enables the cartridge to be readily extracted by the device 27, as already explained, and a fresh cartridge inserted without impediment from the blocking means.

Two diametrically opposite notches (not shown) may be cut in the annular cam 52 to facilitate the passage of the balls 50 when inserting the breech block in the body, such

notches of course being correlated with the inserting position of the lugs 30 relative to the abutments 31. (It should be explained here that the balls 50 and radial passages 51 are shown in the same position relative to the body 1 in all of FIGURES 2, 3 and 4 to aid description, whereas in fact they would be angularly disposed about the axis of the tool in like manner to the lugs 30, for instance (see FIGURE 11), as the breech block 21 is partially rotated in the body 1 from, say, the position shown in FIGURES 2 and 10 to the position shown in FIGURES 3 and 7. The circumferential position of the balls 50, relative to the breech block 21, is of course immaterial.)

The fully extended position of the cartridge plunger, relative to the breech block, as shown in FIGURE 2, is the required position for inserting and extracting the cartridge and, as a further safety measure preventing the assembly or removal of the breech block 21 relative to the body 1, except when the cartridge plunger is in the said required position, a ball check 60 is captively mounted for free lateral movement in the wall of the breech block adjacent one of the lugs 30, said ball check 60 registering with a circumferential groove 61 in the stem 20 when the latter is in the fully extended position.

The arrangement is such that, in any other position, the ball check 60 will protrude outwardly of the wall of the breech block 21 so as to prevent the latter's insertion into the body 1 by striking one of the abutments 31.

It is to be understood that the portion of the stem 20 which is slightly reduced in diameter, or waisted, as shown at 56, does not provide sufficient lateral movement of the ball check 60 to enable it to miss the abutments 31.

When the ball check 60 and the groove 61 are in register, however, the former is enabled to recede into the latter sufficiently to permit the breech block 21 to be inserted into the body 1 (see FIGURE 10) and turned therein until the lugs 30 assume the position shown in FIGURE 7.

Only in the latter position when the breech block has been turned through approximately 90°, i.e. when the stop 33 contacts one of the abutments 31, and the lugs 30 and abutments 31 fully register in correct operative position (see FIGURES 7 and 8), is the ball check 60 released by the abutment 31 to permit inward axial movement of the cartridge plunger 8 upon further release of the balls 40 (see FIGURES 3 and 4.)

Obviously, for the same reason, once the stem 20 has been advanced so that the groove 61 is out of register with the ball check 60, it will not be possible to turn the breech block in the body in the direction to remove it, it being thus positively locked in the correct operative position until the stem 20 is again fully extended to the position shown in FIGURE 2.

Since the cartridge plunger when hammer driven must have sufficient force to detonate the explosive charge in the cartridge before the latter can be fired, a further safety device in the form of yieldable means normally separating the cartridge plunger from the drive plunger can be provided in the form of a coil spring, the coil spring being of such stiffness as to resist accidental dropping or other abuse of the tool even if the first safety device is not effective.

It has been found, however, that a considerable blow can be transferred from the hammer driven cartridge plunger through the cartridge to the drive plunger, and thence to the element, before detonation of the cartridge is effected and therefore the said yieldable separating means may be constituted by a portion of the cartridge itself disposed between the cartridge plunger and the drive plunger.

In the preferred version of the tool the hole 24 is adapted to receive the cartridge 25 so that the latter protrudes at its detonator end about 1/8 inch (see FIGURE 3), the cartridge itself providing yieldable means suffi-

cient for the safe and satisfactory handling and operation of the tool in practice.

Obviously, if, when operating the tool, the resistance to the element is less than that required to detonate the charge (such as when the element is applied to pulp-board, for instance), the cartridge will not be fired and the element will be driven into the material solely by the agency of the first stage mechanism.

In operation the breech block 21 is extracted from the body 1 by firstly fully extending the cartridge plunger 8 with its stem 20, and then turning the breech block 21 through 90° (in a counter-clockwise direction as viewed from the striking end in the example illustrated). To facilitate the turning and manipulation of the breech block 21, a knurled rim 70 is preferably provided.

The tool is thus brought substantially to the position shown in FIGURES 2 and 10 in which position the balls 50 are opposite the notches (not shown) in the annular cam 52 and the breech block, cartridge plunger assembly can be withdrawn.

The cartridge 25 is now inserted into the hole 24, and the said assembly replaced in the body and the breech block turned in a clockwise direction until stopped by the pin 33 in the correct operative position. The cartridge plunger piston 8 is now deliberately released by stressing the sleeve 2, towards and against the flanged end 4 of the body 1, as shown in FIGURE 3, and the cartridge plunger piston 8 slowly traversed by hand along the bore 7 towards the drive plunger 9, pushing the latter before it if necessary, for the full length of its inward travel, i.e. until the head 22 abuts the closure 43.

The element 71 is now inserted in the drive plunger 9, where, at the outward end of the portion 10, provision in the form of a recess 72 is made to receive it; the pointed end of the element 71 placed in the required position on the workpiece and the tool pressed towards the workpiece thereby pushing the element and drive plunger inwardly into the bore 7 to the position shown in FIGURE 4.

This last action also pushes the cartridge plunger outwardly a corresponding distance automatically bringing all the operative parts of the tool into correct operative position.

The sleeve 2, which is gripped by the operator, is now stressed towards the workpiece with sufficient force to release the balls 40 from the stem 20, and the head 22 is struck a heavy blow with a hand hammer, thereby partially collapsing the protruding end of the cartridge 25, as shown in FIGURE 4. If and when the resistance of the workpiece is sufficient, the cartridge is detonated and the resultant explosive power drives the drive plunger 9 along the bore 7, and with it the element into the workpiece, as shown in FIGURE 5.

Gas vents 75, in the body 1, which vents are automatically uncovered by the drive plunger 9 as it traverses the bore 7 on a power stroke, relieve excessive back pressure from causing the cartridge plunger piston 8 to recoil after the drive plunger has done its work.

While the first stage may be simply carried out, such as by a blow with a hand hammer, it is to be expressly understood that the invention is not limited to this arrangement. The one end of the cartridge plunger may be hammer driven by any suitable means under the manual control of the operator.

I claim:

1. In an explosive power assisted hammer driven tool for driving an element such as a nail, pin or stud into material, and having a body with a cylindrical bore therethrough, a cartridge plunger and a drive plunger slidably mounted in said bore and adapted for independent reciprocating movement therein, one end of said cartridge plunger extending out of one end of said bore and being adapted to be hammer driven towards the drive plunger, the drive plunger being movable toward the other end of said bore for only a limited distance and

having an abutting surface at the one end thereof opposed to said cartridge plunger for firing a cartridge upon percussive contact of the detonator end thereof with the said abutting surface and being adapted at its other end to operatively engage the element to be driven; that improvement comprising a cartridge holding means on the other end of said cartridge plunger and adapted to hold a cartridge therein in a fully inserted position such that the cartridge has its detonator end extending toward the drive plunger a short distance from said other end of the cartridge plunger with the rim of the cartridge spaced from and completely clear of and unsupported by the cartridge plunger, whereby only when an element is operatively engaged in the drive plunger and disposed against the workpiece and the cartridge plunger is hammer driven with sufficient force to cause the extending portion of the cartridge to be crushed and thereafter drive the detonator end of the cartridge into contact with said abutting surface, will there be sufficient impact force on the detonator to cause the explosive charge to detonate and drive the drive plunger for the extent of its limited movement and thus force the element into the material, and when the tool is dropped, even on the said one end of the cartridge plunger, the detonator end of the cartridge is not crushed sufficiently to fire the cartridge.

2. An apparatus as claimed in claim 1 in which said cartridge holding means comprises a piston member slidable within the bore of said body and having a recess in the end thereof opposed to the end of said drive plunger, said recess having a depth less than the length of a cartridge, whereby a portion of the length of a cartridge will project from the said other end of the cartridge plunger.

3. An explosive power assisted hammer driven tool for driving an element such as a nail, pin or stud into material, comprising a body with a cylindrical bore therethrough, a cartridge plunger and a drive plunger slidably mounted in said bore and adapted for independent reciprocating movement therein, one end of said cartridge plunger extending out of one end of said bore and being adapted to be hammer driven towards the drive plunger, the drive plunger being movable toward the other end of said bore for only a limited distance and having an abutting surface at the one end thereof opposed to said cartridge plunger for firing a cartridge upon percussive contact of the detonator end thereof with the said abutting surface and being adapted at its other end to operatively engage the element to be driven, a cartridge holding means on the other end of said cartridge plunger and adapted to hold a cartridge therein in a fully inserted position such that the cartridge has its detonator end extending toward the drive plunger a short distance from said other end of the cartridge plunger with the rim of the cartridge spaced from and completely clear of and unsupported by the cartridge plunger, whereby only when an element is operatively engaged in the drive plunger and disposed against the workpiece and the cartridge plunger is hammer driven with sufficient force to cause the extending portion of the cartridge to be crushed and thereafter drive the detonator end of the cartridge into contact with said abutting surface, will there be sufficient impact force on the detonator to cause the explosive charge to detonate and drive the drive plunger for the extent of its limited movement and thus force the element into the material, and when the tool is dropped, even on the said one end of the cartridge plunger, the detonator end of the cartridge is not crushed sufficiently to fire the cartridge.

4. An apparatus as claimed in claim 3 in which said cartridge holding means comprises a piston member slidable within the bore of said body and having a recess in the end thereof opposed to the end of said drive plunger, said recess having a depth less than the length of a cartridge, whereby a portion of the length of a

ridge will project from the said other end of the cartridge plunger.

5. An apparatus as claimed in claim 3 in which said cartridge holding means comprises a piston member slidable within the bore of said body and having an inwardly tapering recess in the end thereof opposed to the end of said drive plunger and the recess having a diameter intermediate the ends thereof which is substantially equal to the diameter of a cartridge, the distance of said diameter from the end of the piston member being less than the length of a cartridge to be held in the piston member.

6. An explosive power assisted hammer driven tool as claimed in claim 3, wherein the said abutting surface of the drive plunger is a plain flat surface, whereby no firing pin or other projection projects from said abutting surface, which thereby forms a further safety means.

7. An explosive power assisted hammer driven tool as claimed in claim 3, wherein the one end of the cartridge plunger extending out of the bore has a counterweight head thereon adapted to be struck by a hand hammer.

8. An explosive power assisted hammer driven tool as claimed in claim 3, including safety means such as a blocking means operative between the body and the cartridge plunger permitting movement of the cartridge plunger toward said one end of said bore relative to the body but preventing movement of the cartridge plunger toward the other end of the bore, and releasing means acting on said blocking means for releasing it, whereby relative movement between the cartridge plunger and said body such that the cartridge plunger moves toward the other end of said bore can be accomplished only by positively actuating said releasing means under the control of the operator.

9. An explosive power assisted hammer driven tool as claimed in claim 8, said hammer driven tool having a breech block mounted in the one end of the body through which said cartridge plunger passes, and wherein the blocking means comprises a plurality of wedging balls, said breech block having a tapered surface internally thereof with which said wedging balls cooperate and spring biased wedging means within said breech block and acting on said wedging balls so as to normally wedge the balls between the tapered surface and the cartridge plunger, the direction of the taper being such as to permit the cartridge plunger to be moved toward said one end of said bore but prevent its movement toward the other end of said bore.

10. An explosive power assisted hammer driven tool as claimed in claim 9, wherein the spring biased wedging means comprises an annular cage in which said wedging balls are mounted, and the releasing means comprise at least one release ball slidably mounted in the breech block for substantially radial movement therein, said cage having a chamfer on the end thereof directed toward the other end of said bore, said release ball upon radially inwardly directed movement engaging the chamfered end of said cage so as to move the cage axially away from said body thereby unwedging the wedging balls, a sleeve externally mounted upon said body in axial sliding relation therewith and adapted to be gripped by the operator, said sleeve being spring biased away from said guide head and having a radially inwardly directed cam on the end of the sleeve remote from the guide head and engageable with said release ball, whereby on movement of the sleeve the said release ball is moved inwardly, and upon application of the tool to the workpiece with sufficient axial force upon the sleeve to overcome the spring bias of said wedging means and the spring bias of the releasing means the blocking means is released and movement of the cartridge plunger toward the other end of the bore is possible so that the cartridge plunger is free to be hammer driven to operate the tool.

11. An explosive power assisted hammer driven tool as

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claimed in claim 10, wherein the breech block has at least one outwardly extending lug thereon and said body has at least one inwardly extending abutment disposed upon the inner circumference of the bore at said one end of the bore and with which said lug cooperates, whereby the breech block with the cartridge plunger slidably mounted therein can be inserted into the said bore until the lug is positioned beyond the abutment and a turning action of the breech block relative to the body moves the lug into register with the abutment on the side thereof toward the other end of the bore to position the breech block in the correct operative position in which axial removal of the breech block from the body is prevented.

12. An explosive power assisted hammer driven tool as claimed in claim 11, including additional means positively preventing the cartridge plunger from being advanced towards the drive plunger until the breech block is in correct operative position in the bore, said means comprising a blocking ball mounted for free lateral movement in the breech block, the cartridge plunger having a circumferential groove therein with which said ball can register, and an abutment in the bore with which the portion of the ball diametrically opposed to the groove engaging portion cooperates, whereby upon sliding the breech block into the bore the said blocking ball is engaged by the abutment and thereby brought into engagement with the said groove thus positively preventing axial movement of the cartridge plunger in the breech block until the breech block has been rotated into correct operative position, in which position the blocking ball is

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automatically released from contact with the abutment thereby freeing the blocking ball from engagement with the groove.

13. An explosive power assisted hammer driven tool as claimed in claim 12, wherein said ball has a diameter substantially greater than the thickness of the wall of the breech block so that it is prevented by the cartridge plunger from moving inwardly a sufficient distance to permit the ball to pass the abutment except when the ball is in register with the said groove the position of which is predetermined, whereby said ball prevents the breech block being inserted into or removed from the body except when the cartridge plunger is in a predetermined position relative to the breech block.

References Cited in the file of this patent

UNITED STATES PATENTS

2,768,375	Catlin	Oct. 30, 1956
2,893,279	Haskell et al.	July 7, 1959
3,115,636	Elliott	Dec. 31, 1963

FOREIGN PATENTS

1,040,789	France	May 27, 1953
1,084,425	France	July 7, 1954
1,109,600	France	Sept. 28, 1955
744,822	Great Britain	Feb. 15, 1956
(Corresponding to the Norway patent)		
772,351	Great Britain	Apr. 10, 1957
84,159	Norway	Aug. 23, 1954
149,829	Sweden	Apr. 26, 1955
302,644	Switzerland	Jan. 3, 1955