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EXPLOSIVE POWER ACTIVATED MECHANISMS

Filed Dec. 9, 1960

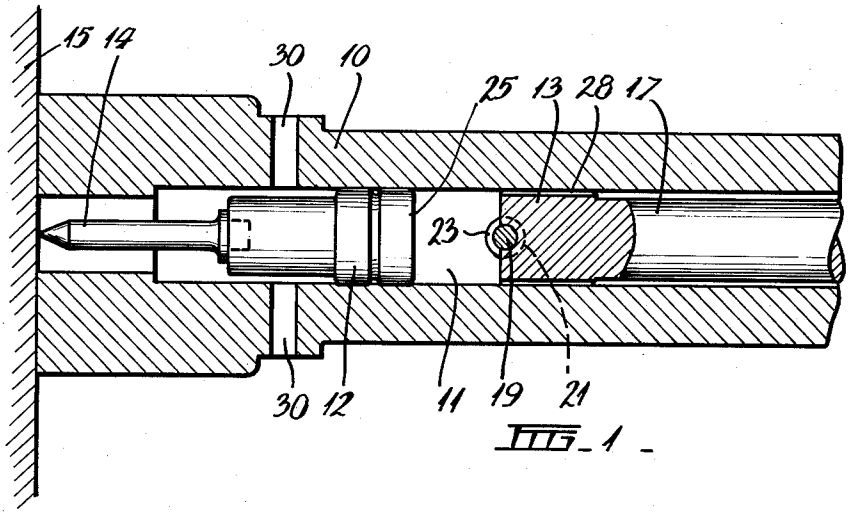


FIG. 1.

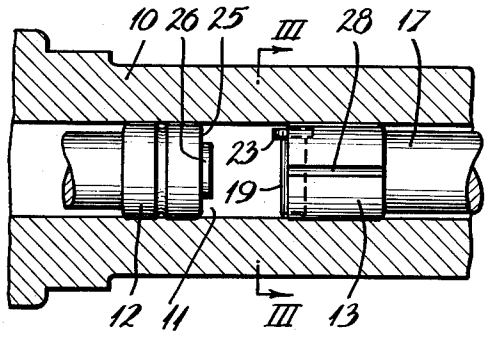


FIG. 2.

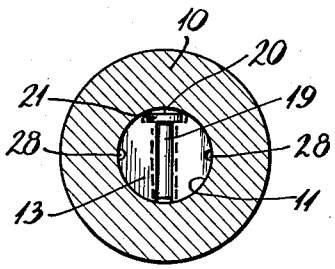


FIG. 3.

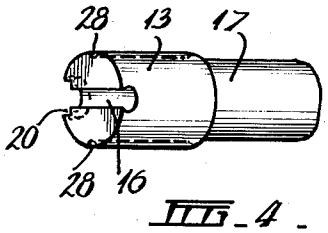


FIG. 4.

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# EXPLOSIVE POWER ACTIVATED MECHANISMS

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6 Claims. (Cl. 1—44.5)

This invention relates to improvements in or relating to explosive power actuated mechanisms such as tools of the type employing a cartridge which, when exploded by manually controlled means, drives a fastener element, such as a nail, pin, stud or the like, into relatively rigid material.

More particularly the invention is directed to a unique mode of employing the cartridge in tools of the above type, and, although the description herein will be chiefly confined to such application, it is to be expressly understood that the scope of the invention may extend to any form of mechanism utilising an explosive cartridge for performing work.

The general principle of operation of explosive power actuated tools (or "powder-powered" tools as they are sometimes called) is now well-known and for a variant of the usual type, which variant includes an axially movable cartridge-holding member, or cartridge plunger, manually actuated to effect detonation of the cartridge which operates a driving member, or drive plunger, the reader is referred to my application Serial Number 855,126.

The more common method of detonating the cartridge is by a firing pin or striker pin, the cartridge being relatively stationary, it being understood that the cartridges used in tools of this general kind are of the rim-fire type.

In practically all known tools or mechanisms utilising a cartridge the latter is disposed with its longitudinal axis substantially parallel to the direction in which the explosive power is applied.

One known exception positions the cartridge in the side of the driving member so that its axis is transverse to the direction in which the drive takes effect and redirects the operative gases of the exploded cartridge through passages in the said driving member. In this case the cartridge is breeched against the wall of the bore in which the driving member, in the form of a piston, works. Its effectiveness is thereby negatived and the arrangement is not successful in practice.

It is known, however, to reverse the usual forward-pointing disposition of the cartridge so that its detonator end is facing in the operative direction of the tool and this arrangement is considered to have certain advantages, although it has presented difficulties in extracting the spent cartridge after explosive action.

Now I have discovered, and this discovery forms the basis of the present invention, that quite unexpected and extraordinarily beneficial results obtain in mechanisms of the type under consideration by disposing and supporting the cartridge so that it explodes sidewardly relative to its longitudinal axis, which latter is preferably disposed transversely to the direction in which the explosive power is applied.

Such an arrangement in "powder-powered" tools and the like is quite feasible as the cartridge plunger or other cartridge containing part of the tool is, or can conveniently be made, of greater diameter than the length of the



cartridge. (Those conversant with the art will be aware that cartridges used in the more modern industrial tools may be very short).

The transverse arrangement renders insertion and subsequent extraction of the cartridge extremely facile whilst at the same time simplifying manufacture. This disposition is, however, not an essential feature provided the cartridge is so supported that, upon detonation, it bursts the side of the cartridge case preferably in the direction of the drive plunger.

Detonation of the explosive charge may be effected by either a direct or indirect percussive blow upon the periphery of the cartridge rim and such a blow may be engendered in the operative direction of the tool or in a direction axial of the cartridge, or in any other convenient direction.

In one example of the invention the cartridge is contained in a transverse, part-cylindrical hole in the cartridge holder, the side of the hole directed towards the direction in which the explosive power is applied being open to permit the cartridge, when detonated, to burst side-ways. The cartridge thus is breeched against the cartridge holder as in the best practice. This unique method of cartridge operation provides a considerably greater area of immediately available explosive energy at the moment of firing of the charge thereby increasing the efficiency of the tool or mechanism. It also promotes much cleaner operation as virtually all of the explosive charge is burnt and disappears as exhaust gas.

It is found that, in an arrangement as above described, the spent cartridge case is quite loose in the hole in the cartridge holder after it has been exploded and falls out without difficulty when the cartridge holder is removed from the tool.

To further facilitate the extraction of the cartridge, the part-cylindrical hole may be slightly tapered in the direction in which the cartridge is inserted.

In the type of tool employing a manually actuated, reciprocable cartridge plunger, such as that disclosed in my application Serial Number 855,126, the cartridge, if disposed according to the present invention, may be detonated by simple percussive contact of the periphery of the cartridge rim with the drive plunger, which latter drives the element into the work.

The drive plunger, sometimes called piston or "snap hammer," is a reciprocable member interposed between the element to be driven and the explosive charge and is usually arranged like a floating piston or plunger in the body of the tool responsive to the power produced by the instantaneously expanding gases generated by the exploded cartridge.

As a safety measure in practice the inwardly directed end of the drive plunger (which end is juxtaposed the cartridge-holding end of the cartridge plunger and may be employed to contact the cartridge rim as a means of detonation) is preferably provided with a centrally disposed boss or spigot of a diameter to miss the said rim and protruding axially a sufficient distance to cause the body of the cartridge to be appreciably crushed thereby before the rim contacts the drive plunger proper.

Clearly then, for a blow to be sufficiently percussive upon the cartridge rim to cause detonation and firing of the charge, it must first overcome the resistance entailed

in crushing the body of the cartridge to a predetermined extent.

Any or all of the safety devices disclosed in my application Serial Number 855,126 may be employed in lieu of or in addition to the above described safety measure.

One practical arrangement of the invention will now be described with reference to the accompanying drawings, in which:

FIGURE 1 represents a longitudinal section of an explosive powered tool, showing the drive plunger and fastener element (before driving), and the cartridge plunger with a cartridge in situ, disposed according to the invention.

FIGURE 2 shows the relevant parts of FIGURE 1, when turned through an angle of 90°, and includes a modified form of drive plunger.

FIGURE 3 is an end elevation taken on the line III—III of FIGURE 2.

FIGURE 4 is a perspective view of the cartridge holding end of the cartridge plunger with the cartridge removed.

The body **10** of an explosive powered, or "powder-powered," tool has, in the example taken, a common bore **11** in which a drive plunger **12** and a cartridge plunger **13** are reciprocably mounted. A fastener element or pin **14** is shown positioned in the driving end of the drive plunger **12** and disposed against a work-piece **15**, upon which latter the body **10** is operatively pressed in known manner.

The cartridge plunger **13** has a stem **17** which, in the example taken, extends outwardly of the body **10** and is adapted for manual actuation whereby the cartridge plunger **13** may, upon the release of suitable safety devices, be moved towards the drive plunger **12**.

Adjacent the inward end of the cartridge plunger **13** is a cartridge supporting means, or cartrideg holder, in the form of a part-cylindrical hole **16**, best seen in FIGURE 4. Preferably this hole **16** is diametral of the cartridge plunger **13** as such an arrangement facilitates manufacture and cartridge extraction, as well as providing an open-side to the hole **16** which, in all circumstances, is fully presented to the drive plunger whereby the cartridge **19** is enabled to explode sidewardly with the greatest effect.

The hole **16** is counter-bored at at least one end, said counter-bore **20** being adapted to receive the detonator head **21** of the cartridge **19** so that the whole of the cartridge is contained within the diameter of the cartridge plunger **13** and clear of the bore **11** when in situ. Obviously the hole **16** could be counter-bored at both ends so that the cartridge could be inserted from either side of the plunger **13**.

This arrangement results in the rim **23** of the cartridge head **21** being directed towards the drive plunger **12** and so disposed that, upon the cartridge plunger **13** being propelled towards the drive plunger **12**, the rim **23** will come into percussive contact with the end surface **25** of the drive plunger **12** in the most advantageous manner for efficient detonation of the cartridge.

In certain types of explosive power actuated mechanisms, for example the cartridge assisted industrial tool described in my application Serial Number 855,126 wherein the cartridge plunger **13** is manually driven (such as by a hand hammer), it is an advantage if the cartridge does not explode until the resistance to pin **14** by the workpiece **15** exceeds a predetermined value. To meet this requirement the drive plunger **12** may be provided with a spigot **26** of such diameter as to miss the rim **23** but protruding axially a sufficient distance to crush the body of the cartridge **19** before the rim **23** contacts the end **25** of the drive plunger **12**.

The crushing of the body of the cartridge, within limits, will not detonate it, whilst immediately the resistance to the pin **14** is sufficient to bring the rim **23** into contact with the surface **25** detonation takes place. This acts also as a safety measure.



It has a further function, however, namely, the precompression of the explosive charge in the cartridge promotes considerably higher energy release upon detonation and this coupled with the greater effective area available in a sidewardly exploding cartridge according to the invention, results in an extraordinary increase in the efficacy of the tool or mechanism. It also promotes much cleaner operation as, in practice, virtually all of the explosive charge is burnt without residue.

It will be understood by those skilled in the art that as the drive plunger **12** approaches the end of its outward movement it uncovers gas vents **30** in the body **10** for release of the spent gases resulting from the exploded cartridge.

To guard against excessive recoil should the gas vents **30** fail to be uncovered due to the resistance of the workpiece **15** proving too great for full penetration of the pin **14**, by-pass means such as one or more bleeder grooves **28** may be provided in the cartridge plunger **13**. These grooves **28** are so proportioned that no appreciable passage of gases takes place so long as the drive plunger **12** is giving way in the driving direction. In the event of excessive pressure build-up in the region between the drive plunger **12** and the cartridge plunger **13**, however, the grooves **28** act as a relief means to prevent or reduce recoil.

I claim:

1. An explosive power actuated mechanism having a first member and a second member movable relative to each other, said first member having an open-sided hole therein for holding a cartridge with a side portion of the cartridge body and a portion of the rim of the cartridge protruding through the open side of the hole, and the second member having a projection thereon opposed to the part of the open side of the hole through which the side portion of the cartridge body projects and adapted to contact the protruding body portion of the cartridge before the rim portion of the cartridge contacts the second member, whereby upon the two members being percussively brought together the body of the cartridge is partially crushed by the said projection before the rim of the cartridge is detonated by contact with the second member, whereafter the cartridge explodes sidewardly of its body through the open-side of the hole to perform work upon the second member.

2. An explosive power actuated tool employing a rimfire cartridge and comprising an axially movable cartridge plunger for carrying the cartridge and a co-axially movable drive plunger for driving a fastener element, said cartridge plunger having a part-cylindrical open-sided hole therein located near the end of the cartridge plunger opposite the drive plunger for holding a cartridge with a side portion of the cartridge body and a portion of the rim of the cartridge protruding beyond the said end of the cartridge plunger, the drive plunger at the end thereof opposed to the cartridge plunger having a projection thereon opposed to the part of the open side of the hole through which the side portion of the cartridge projects for contacting the protruding body portion of the cartridge before the rim portion of the cartridge contacts the drive plunger, whereby upon the two plungers being percussively brought together the body of the cartridge is partially crushed by the said projection before the rim of the cartridge is detonated by contact with the drive plunger, whereafter the cartridge explodes sidewardly of its body through the open-side of the hole and drives the drive plunger.

3. A tool as claimed in claim 2, wherein the part-cylindrical open-sided hole for supporting the cartridge extends diametrally of the cartridge plunger.

4. A tool as claimed in claim 2, wherein the part-cylindrical open-sided hole for supporting the cartridge has a counter-bored portion at at least one end thereof

to receive the rim of the cartridge, whereby the whole of the cartridge is contained within the diameter of the cartridge plunger.

5. A tool as claimed in claim 2, wherein the cartridge plunger has by-pass apertures therein for relieving excessive recoil of the said plunger after explosion of the cartridge.

6. In an explosive power actuated mechanism employing a rim-fire cartridge to operate a member, a cartridge holder movable towards the member and having an open-side corresponding to a side of the cartridge through which the cartridge explodes sidewardly upon detonation and operates the member, means being provided on the



member to partially crush the cartridge in the cartridge holder before the cartridge is detonated by contact with the member.

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