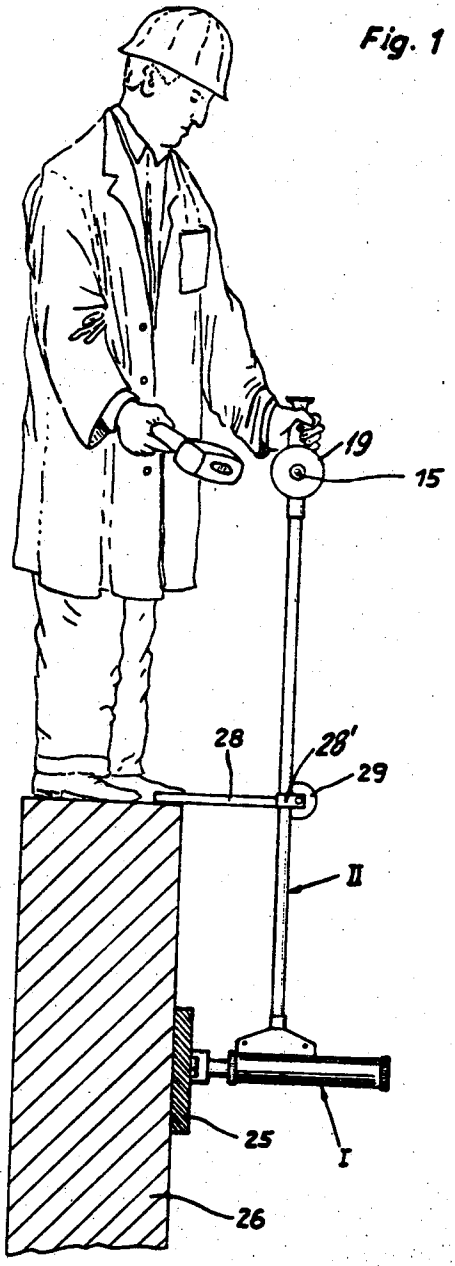
Dec. 9, 1969 W. BAYER ET AL 3,482,753

EXPLOSIVE DRIVEN STUD SETTING APPARATUS FOR USE IN HARD-TO-REACH PLACES

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Fig. 1



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Fig. 4

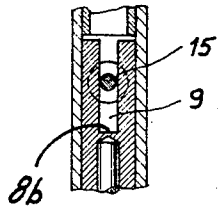


Fig. 2

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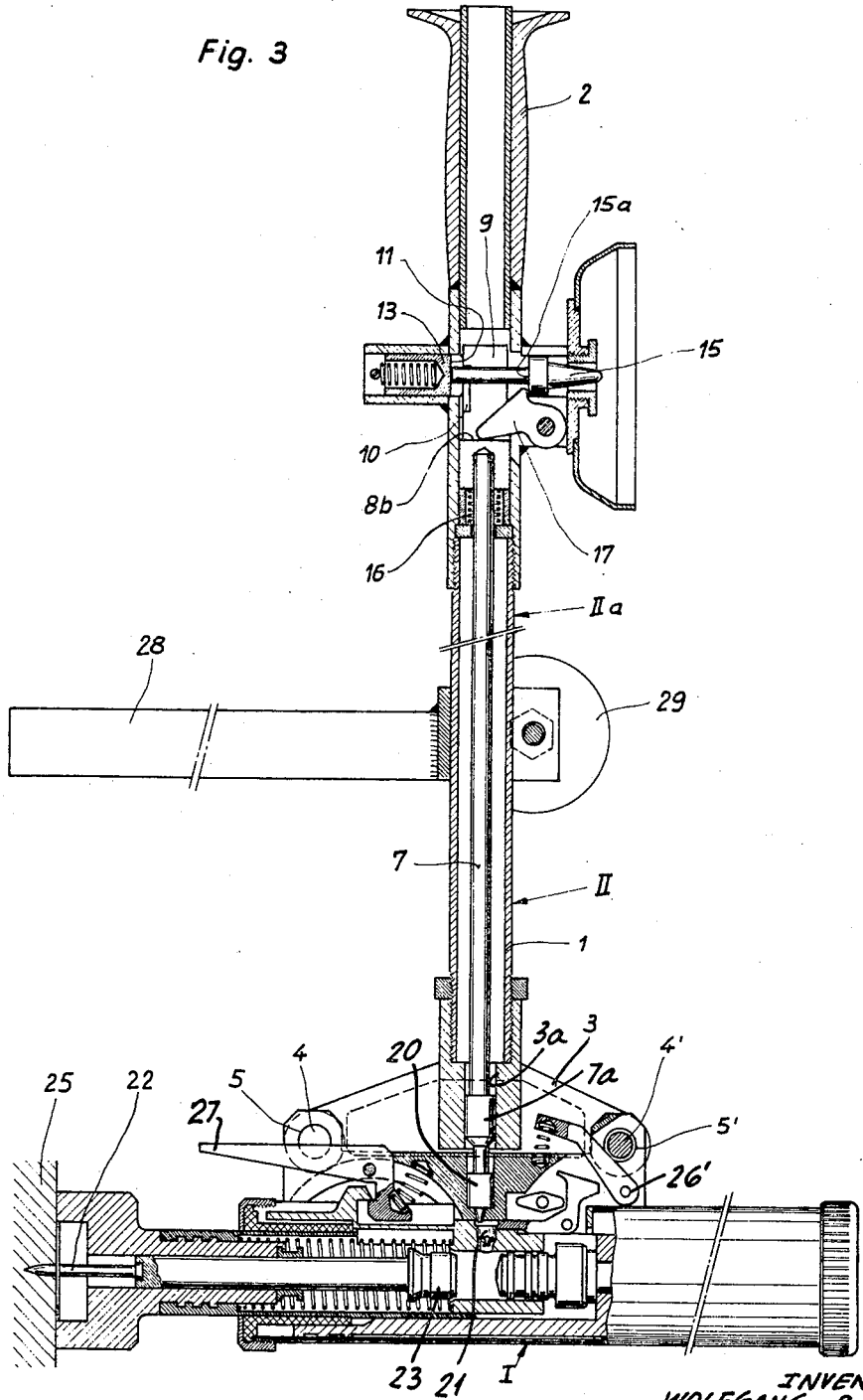
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Fig. 3



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EXPLOSIVE DRIVEN STUD SETTING APPARATUS FOR USE IN HARD-TO-REACH PLACES

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Int. Cl. B25c 1/14
U.S. Cl. 227—10 10 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for securing exothermic plates to the inner surfaces of upright casting molds includes an explosive actuated nail or stud driving device having a longitudinally extending driving axis and a relatively elongated supporting device secured to the driving device perpendicularly to the driving axis of the latter. Thereby the driving device may be positioned in operative engagement with an exothermic plate positioned against the inner surface of an upright mold, with its driving axis substantially perpendicular to the plate outer surface, by an operator standing on the upper end of the mold and manually gripping the upper portion of the supporting device. Remote actuating means for the driving device are mounted within the supporting device and include an elongated impact element engageable with the impact member of the driving device and a trigger pivoted on the upper portion of the supporting device and operated by impact against an actuating member.

BACKGROUND OF THE INVENTION

This invention relates to explosive driven stud setting apparatus and, more particularly, to a novel apparatus of this type for use in hard-to-reach places, such as in the fastening of exothermic plates on the inner surfaces of molds.

As is known to those skilled in the art, the inner surfaces of casting molds, adjacent the upper part of the mold, are lined with heat-insulating so-called exothermic plates for the purpose of retarding the cooling of liquid or molten metal poured into the mold. By the use of these plates, the formation of so-called "piping" in the casting is prevented at least to a large extent. These exothermic plates extend partially into the mold, up to 1.50 meters, and difficulties arise, especially when the opening of the mold is very narrow, in fastening the plates to the mold wall. Such fastening preferably is effected by means of stud or nail driving or setting apparatus.

An object of the present invention is to provide such a stud or nail setting or driving apparatus by means of which the nail or stud setting or driving operation can be carried out in a simple manner in the case of molds having narrow openings and in which the nails or studs are positioned, for fastening of the exothermic plates to the mold, at a considerable distance from the upper end of the mold.

Another object of the invention is to provide a stud or nail setting or driving apparatus having a supporting device or extension for supporting the apparatus from the upper edge of the mold.

A further object of the invention is to provide a stud or nail setting or driving apparatus, having a supporting device or extension by means of which it may be supported on the upper edge of the mold, and including an actuation member at the upper end of the supporting device, which upper end protrudes from the mold, this actuation device being part of a remote control for the ignition of the explosive.

Yet another object of the invention is to provide such

a stud or nail setting or driving apparatus which may be positioned by the operator, standing at the edge of the mold, through the medium of the supporting device, and in which the ignition may be effected from a position outside of the mold.

Preferably, the stud or nail setting or driving apparatus is essentially the same as that described in co-pending U.S. patent application Ser. No. 449,833, now Patent No. 3,338,496, and wherein the cartridge case is disposed at an angle to the driving axis of the apparatus, with the cartridge being ignited by impact.

A further object of the invention is to provide a supporting device for such an apparatus comprising a pipe having an ignition rod or impact element movable longitudially thereof to transmit the ignition impact to the cartridge.

Still another object of the invention is to provide such a supporting device including a pipe, with the pipe having a bearing element adjustably mounted thereon for co-action with the edge of the mold to position the stud or nail driving or setting apparatus, mounted at the lower end of the pipe, at various depths within the mold.

As a rule, explosive driven stud or nail setting devices are provided with a so-called bearing safety device. For example, the apparatus is supported lengthwise, as against the case, by means of a pressure spring so that, only after overcoming of a predetermined bearing force at the explosive, it is possible to effect ignition. In the apparatus embodying the present invention, such a safety device of the usual type cannot be used, since the necessary bearing force cannot be exerted by an operator standing on the edge of the mold. Consequently, for safety reasons, it is necessary to assure, in some other way, that free shots and the like are avoided.

Accordingly, a further object of the invention is to provide a supporting device in the nature of a pipe and in which the pipe, adjacent its upper end, is formed with the radial recess through which a spring-loaded actuation member is shiftable at right angles to the pipe axis, there being a spring biasing the impacting rod upwardly of the pipe, and this actuation member, upon impact, operating through a pivoted element to move the impacting rod downwardly, against the bias of such spring, to impart an impact to the cartridge to ignite the latter.

For an understanding of the principles of the invention, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a schematic representation of the apparatus in use to fasten an exothermic plate to the inner surface of a casting mold;

FIG. 2 is an enlarged side elevation view of the apparatus, partly in section, illustrating the apparatus in the resting or non-actuated position;

FIG. 3 is a view similar to FIG. 2, illustrating the apparatus as actuated; and

FIG. 4 is a cross sectional view along the line IV of FIG. 2.

In the drawings, the explosive actuated nail or stud driving or setting apparatus, as a whole, is designated I, and this apparatus is positioned on a supporting device designated, as a whole, II.

Supporting device II comprises pipe 1 having a generally tubular handle 2 secured to its upper end. The lower end of pipe 1 carries a bracket 3 having journals 4 and 4' extending at right angles to pipe 1. Apparatus I is supported on journals 4 and 4' by correspondingly designed eyelets or apertured ears 5 and 5'.

An ignition or impact rod 7 is mounted through pipe 1 for displacement longitudinally of the latter, the upper

end of rod 7 being secured in a journal 8 slidable in pipe 1. As best seen in FIG. 4, journal 8 has a slot 9 opening through its upper end, this slot being centered on a radial and diametric plane through the journal. In addition, journal 8 has a circular cross section recess 10 milled in its external cylindrical surface and having an axis which extends radially of journal 8 substantially centrally of slot 9. The diameter of recess 10 is greater than the width of slot 9, and recess 10 intersects and communicates with slot 9.

In the general area of journal 8, pipe 9 is formed with diametrically opposed openings 11 and 12. A spring-loaded, circular cross section locking piece or plunger 13, in the non-actuated or rest position of the apparatus, seats in milled recess 10 of journal 8 and thus holds ignition or impact rod 7 firmly against axial displacement. By means of this locking piece 13, an accidental ignition or impact by the heavy ignition rod, in the event of striking of the apparatus, is prevented. Locking piece or plunger 13 is slidably movable in a tubular sleeve 13*a* welded or otherwise secured to the external surface of pipe 1 to project radially outwardly therefrom. Locking piece or plunger 13 is biased radially inwardly by a spring 13*b* engaged between plunger 13 and a pin 13*c* extending transversely of sleeve 13*a*.

An actuating member 15, which is shiftable diametrically of the pipe 1, extends through the opening 12 and includes a stem extending transversely of slot 9 and having an end engaging the inner end of locking piece or plunger 13. Actuating member 15 carries a relatively massive cylindrical collar 15*a* which is slidable in a tubular passage in a mounting piece 15' extending radially outwardly of pipe 1, at opening 12. The radially outer end of member 15 is formed with a relatively massive impact portion 15*b* which extends through a bushing 30 threaded into a plate 31 on the outer end of mounting piece 15'.

Spring 13*b*, through locking piece or plunger 13 engaging actuating member 15, biases actuating member 15 in a radially outward direction to abut collar 15*a* against bushing 30, in a non-actuated condition of the apparatus. When impact head 15*b* of actuating member 15 is struck, the stem of member 15 pushes locking piece or plunger 13 radially outwardly against the force of spring 13*b*, disengaging locking piece or plunger 13 from milled recess 10.

An annular shoulder member or collar 14 is fixedly mounted within pipe 1 and, between this shoulder and the lower face 8*a* of journal 8, there is disposed a compression spring 16 which biases journal 8 upwardly to a position where it is locked by engagement of locking piece or plunger 13 in milled recess 10. A spacer sleeve 14*a*, seated on collar 14 and telescoped within pipe 1, limits downward movement of journal 8.

Actuating member 15 is enclosed by a protective cap 19 mounted on the flange 31 and surrounding and protecting the actuating head 15*b* of member 15. Collar 15*a* is arranged, upon impact of member 15, to engage a shoulder 17*a* on a pivoted member or trigger 17 which is pivotal on a journal 18 extending transversely of element 15'. Trigger 17 extends into slot 9 and lies against the bottom surface 8*b* of the slot. In the non-actuated position of the parts, collar 15*a* is spaced from shoulder 17*a*.

When actuating member 15 is struck, collar 15*a* pivots lever or trigger 17 and, after locking piece or plunger 13 has been disengaged from milled recess 10, this moves ignition or impact rod 7 downwardly without restraint by locking piece or plunger 13.

Adjacent its lower end, impact or ignition rod 7 is formed with an enlargement 7*a* acting as a journal engaged in a relatively small diameter passage 3*a* of an extension 3*b* of bracket 3, extension 3*b* being threaded to the lower end of pipe 1. The lower end of ignition rod 7 extends into the bearing passage of ignition pin 20 of the explosive actuated setting apparatus I. Thereby, ignition pin 20 is impacted against cartridge 21 as soon as rod 7 hits pin 20, whereupon cartridge 21 is ignited or fired and a piston 23, which drives a bolt or nail 22 into the material, is moved in a firing direction. By virtue of this driving of stud or nail 22, exothermic plate 25 is secured to the inner surface of the wall mold 26.

As the apparatus I is of a design known per se, it is not believed necessary to describe the same in detail. However, it should be noted that, by releasing the spring biased locking lever 27, the apparatus I may be swung counter-clockwise about the point 26' for the purpose of inserting a new cartridge 21.

In FIGS. 2 and 3, the upper part II*a* of the pipe II has been rotated through 90° relative to the lower part of pipe II, about the axis of the pipe. For the purpose of adjusting the operating level of apparatus I, a gauge or stop member 28 is provided. Member 28 is formed with a split sleeve 28' embracing pipe 1 and, by virtue of this construction, gauge 28 may be shifted longitudinally of pipe 1 and then locked in any desired position by tightening set screw 29. As may be seen in FIG. 1, the gauge 28 may be positioned to engage the upper end of mold 26 to position apparatus I at the proper position for driving nails or studs to anchor exothermic plate 25 to the inner surface of the wall of mold 26.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the principles of the invention, it should be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. An explosive actuated nail or stud driving apparatus for use in hard-to-reach places, particularly in securing exothermic plates to the inner surfaces of casting molds, said apparatus comprising, in combination, an explosive actuated nail or stud driving device having a longitudinally extending driving axis and including a driving piston movable along said axis, an explosive receiving chamber in operative relation with said driving piston and explosive ignition means operable, when actuated, to ignite explosive in said chamber to drive said piston; a relatively elongated supporting device secured in supporting relation to said driving device; support means on said supporting device engageable with the upper end of a casting mold to support said devices with said supporting device extending upwardly from the mold and said driving device at a pre-set driving location within the mold; and remote actuating means for said ignition means, including an actuating member adjacent the upper end of said supporting device; said ignition means comprising an impact member igniting the explosive by impact; said remote actuating means including a relatively elongated impact element reciprocable longitudinally of said supporting device and having a lower end engageable with said impact member; said actuating member being operable to reciprocate said impact element to drive said impact member to impact the explosive to ignite the latter.

2. Apparatus, as claimed in claim 1, in which said explosive receiving chamber comprises a cartridge chamber extending at an angle to said driving axis and receiving impact ignitable cartridges for ignition upon impact by said impact member.

3. Apparatus, as claimed in claim 2, in which said supporting device comprises an elongated pipe substantially co-axial with the axis of said cartridge chamber; said impact element comprising a relatively elongated rod reciprocable axially of said pipe.

4. Apparatus, as claimed in claim 3, in which said support means comprises a bearing member extending laterally from said pipe and adjustable to fixed positions along said pipe to select the depth of operation of said driving device relative to the upper end of the mold.

5. Apparatus, as claimed in claim 3, in which said actuating member is mounted for movement transversely of said pipe by striking of said actuating member; and a

trigger pivoted on said pipe and interposed between said actuating member and the upper end of said rod, said trigger, upon striking of said actuating member, being rotated by said actuating member to move said rod downwardly to drive said impact member.

6. Apparatus, as claimed in claim 5, including a circular cross section journal secured to the upper end of said rod and slidable within said pipe; means engaged with said journal and biasing said rod upwardly of said pipe; said pipe being formed with a laterally opening aperture adjacent said journal; said actuating member and said trigger extending through said aperture; and means biasing said actuating member upwardly relative to said aperture.

7. Apparatus, as claimed in claim 6, in which said journal is formed with a slot extending axially and diametrically thereof and opening through its upper end; said actuating member extending through said slot; said trigger extending into said slot and being engaged with the bottom surface of said slot.

8. Apparatus, as claimed in claim 7, including a second aperture opening laterally through said pipe in diametrically opposed relation to said first mentioned aperture; said biasing means for said actuating member comprising a locking plunger reciprocable diametrically of said pipe through said second aperture and engaged with a stem of said actuating member; said biasing means for said actuating member further comprising spring means biasing said locking plunger inwardly relative to said second aperture.

9. Apparatus, as claimed in claim 8, including a circular cross section recess formed in the lateral surface of said journal and aligned with said locking plunger when said rod is at its upper position; said recess intersecting said slot and the axis of said recess extending centrally of said slot; said locking plunger having a circular cross section whose diameter is somewhat less than the diameter of said recess whereby, when said rod is in its upper position, said spring biases the inner end of said locking plunger into said recess to lock said rod in its upper position; said locking plunger being disengaged from said recess upon striking of said actuating member to release said rod for downward impact movement by striking of said impact member against said pivoted trigger.

10. Apparatus, as claimed in claim 9, including an outwardly opening guard surrounding the striking end of said impact member.

References Cited

UNITED STATES PATENTS

3,145,387	8/1964	Adolph	227—10
2,228,373	1/1941	Slater	248—2
3,338,496	8/1967	Burtscher	227—10
3,310,215	3/1967	Bostick	227—111

FOREIGN PATENTS

211,001	2/1924	Great Britain.

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