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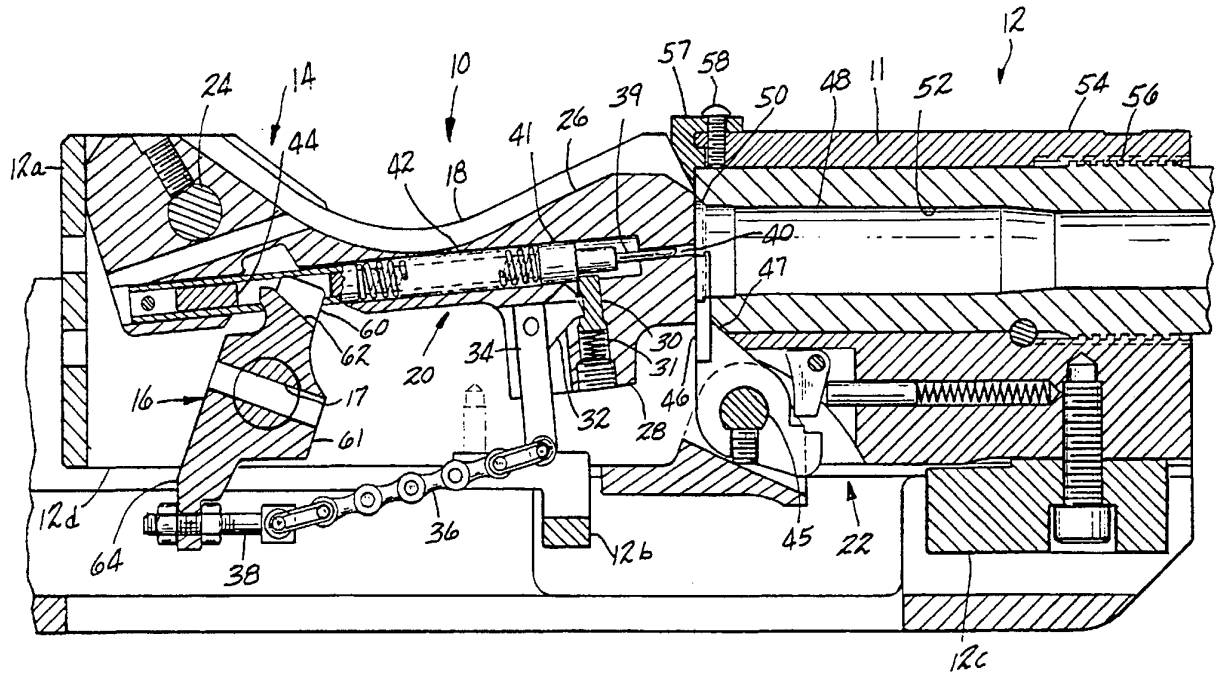
(54) Title: AUTOFIRE MECHANISM FOR INDUSTRIAL GUNS



(57) Abstract

An industrial gun (10) which has an autofire mechanism (20) which automatically pulls its own trigger (34) in response to continued movement of a breech (18) closing handle in the closing direction (66) and the method of use of such a gun (10).

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AUTOFIRE MECHANISM FOR INDUSTRIAL GUNS

This invention relates generally to industrial guns. More particularly, the invention relates to manual firing mechanisms for industrial guns of the type having a rotary handle operated pivoting combination loading ramp and breech block.

Industrial 8 gauge shotguns have been used for many years to shoot 8 gauge shotgun slugs into rotary kilns to knock off slag rings which form on the interior of the kilns. Such kilns are large and hot and the use of such guns avoids the previous practice of allowing the kiln to cool and having men enter the kiln and beat the rings off with hammers and picks. With the industrial 8 gauge kiln gun, the kiln need not be cooled and no men have to enter the kiln. The industrial 8 gauge kiln gun pays for itself by greatly reducing down time. One leading 8 gauge kiln gun is the WINCHESTER RINGBLASTER brand gun made and sold by the Winchester Division of Olin Corporation, East Alton, Illinois. The current version of that gun is the one described in US Patent No. 4,444,088 to Olson and an alternative version proposed to use a pistol type hand grip is shown in US Patent No. 4,986,019 to Dennis.

This invention seeks to improve the firing mechanism of that type of gun to allow it to be loaded with one hand and fired with the other to speed up the firing rate yet retain safety and control. The faster rate further reduces kiln down time.

A new technical approach is needed which can allow such one handed operation.

These problems are solved in the process of the present invention described and claimed below in which gun is automatically fired when the breech block is fully closed. This is done by connecting the breech block handle by a flexible pulling means

to the gun's trigger in such a way that the pulling means pulls the trigger when the breech block handle is fully rotated toward a closed breech position.

The invention will be better understood by reference to the enclosed drawing in which:

FIG. 1 is a vertical sectional view of a kiln gun taken along the axis of the gun barrel showing the autofire mechanism of the invention in the breech closed position just before firing;

FIG. 2 is a vertical section identical to FIG. 2 except showing the gun at the moment of firing; and

FIG. 3 is a vertical section identical to FIGS. 1 & 2 but showing the autofire mechanism in the breech open position for loading.

The current best-selling industrial 8 gauge kiln gun is that shown and described in US Patent No. 4,444,088 to Olson. This invention simplifies the process of firing the gun automatically by connecting the trigger directly to the cocking cam through a flexible puller such as a small roller chain and links with an adjusting bolt. Rotation of the cocking cam closes the breech block in conventional manner, but at the very end of the cam's rotation, now also pulls the puller which in turn pulls the trigger. The invention improves customer satisfaction by minimizing down time of the kiln and by greater reliability of the gun through simplification and elimination of parts.

Referring first to Figure 1, the preferred kiln gun 10 comprises a receiver 12, a barrel 11 and a breech block assembly 14. Breech block assembly comprises a cocking cam 16, a breech block 18, a firing mechanism 20 and an extraction mechanism 22.

Breech block 18 is rotably mounted on a pivot pin 24 of receiver 12. Breech block 18 comprises a

loading ramp 26, a foot portion 28 and a bore 41. Firing mechanism 20 comprises a sear 30, a sear spring 31, a sear puller 32, a trigger 34, a chain 36, a chain adjusting bolt 38, a firing pin 39 with a tip 40 and a body 41, and a firing pin spring 42. Body 42 of firing pin 39 has a cam slot 44.

Extraction mechanism 22 is mounted on a pin 45 of receiver 12 and includes an arcuate extractor 46 and an extractor cam 47.

Barrel 11 is intended to hold a shotshell 48 (adapted to be used with the invention, but not a part of the invention) of any suitable gauge with a rim 50, such as an 8 gauge shotshell loaded with an industrial slug of conventional type. Barrel 11 is provided with a barrel chamber 11 for this purpose. Barrel 11 is mounted in a barrel holder 54 by threads 56 or other suitable means. A locking lip 57 is mounted on the rear of the barrel liner 54 by a screw 58 or other suitable means in order to limit the upward movement of block 18 at a position lining the firing pin up with the center of the base of a shotshell 48 in chamber 52. Barrel holder is held in receiver 12 by a fastener 59.

Receiver 12 has a backframe portion 12a, a pivot pin 24, a footrest portion 12b, a barrel holder mounting portion 12c, and two sideplates 12d. Pivot pin 24 and extractor mounting pin 45 are each held in holes (not shown) of the sideplates 12d. Fastener 59 is fastened to portion 12c and foot rest 12b is positioned to restrain the downward movement of foot 28 of block 18.

Cocking cam 16 comprises a pin 17, a raising arm 60, a main body 61, a lowering arm 62 and a firing arm 64. Body 61 is mounted rotably on pin 17 and pin 17 is mounted in holes (not shown) in sideplates 12d. One or more raising arms 60 extend

upwardly from body 61. Lowering arm 62 extends upwardly and rearwardly from body 61 and firing arm 64 extends downwardly from body 61.

In operation, the parts have the position shown in FIG. 1 when the gun is cocked just prior to firing.

To fire the gun from the position in FIG. 1, the sequence of actions shown in FIG. 2 are instituted by rotating cocking cam 16 clockwise as shown by arrow 66. A handle (not shown) is conventionally provided on cocking cam 16 for purposes of rotation. The clockwise rotation of cam 16 tightens chain 36 and moves chain 36 rearwardly in the direction of arrow 68. Chain 36 in turn pulls rearwardly on the lower end of trigger 34 to rotate it clockwise in the direction of arrow 70. Sear puller 32 is rigidly connected to trigger 34 so that puller 32 is rotated downwardly and pulls sear 30 downward to release the body 41 of firing pin 39. Firing pin 40 moves rapidly forward under the force of firing spring 42 and tip 40 slams into the center of shotshell 48 causing it to fire.

Once the shotshell has fired, the shell has to be removed and the gun readied for loading of the next shell. This sequence of events is shown in FIG. 3. The cocking cam 16 is rotated counterclockwise as shown by arrows 76 causing lowering arm 62 to move rearwardly in cam slot 44 against the firing pin body. This causes the firing pin to move rearwardly allowing sear 30 to reengage body 41. The rearward movement also allows raising arm 60 to align with and enter a recess in the breech block, allowing the block 18 to fall clockwise in the direction of arrow 80 to pull loading ramp 26 downwardly in the direction of arrow 82 to a point sufficient to fully expose the rim 50

of shotshell 48. This frees extractor cam 47 to rotate counter clockwise and force extractor 46 rearwardly as shown by arrow 86 pulling shotshell 48 by its rim 50 backwardly at least partially out of chamber 52. The shotshell can now be pulled completely out of chamber 52 and discarded. The gun is now ready to be loaded again.

A new shell is then placed onto loading ramp 26 and shoved into chamber 52. Then the cocking arm is rotated back clockwise to the position in FIG. 1 to prepare for the next shot, causing raising arm 60 to push against the front wall of recess 79 to force block 18 upwardly to close the breech of the gun. It will be noted that the raising arm must move out of recess 79 before contacting the forward end of cam slot to compress the firing spring 42. Further movement of the cocking arm clockwise causes the firing spring to compress and the trigger to be pulled, which in turn causes the gun to fire again. The cocking cam is then rotated counterclockwise to allow the breech block to fall and the shell be extracted. The process is repeated until the kiln is cleaned.

It will be noted that all the operator of the gun has to do is move the cocking lever and remove and insert shells. A reasonably ambidextrous person can remove and load shells with one hand while moving the cocking cam handle with the other hand. The operator need not release the handle at all, thus greatly simplifying operation and allowing much greater speed and reliability. With prior guns, it was generally necessary to use two operators to obtain full speed since there were three handling operations involved: (1) handle movement , (2) shell handling and (3) trigger pulling. This invention combines the first and third handling operations so

that a two handed person only has to perform two operations. The position of FIG.3 is a safe position with the firing pin out of alignment so that storage of the gun can be made safe by simply locking the handle of the cocking cam in that position or locking the breech bolt in that position. Alternately, the gun could be fired once with the chamber empty to relieve tension on the firing spring and close the chamber to prevent dirt from entering the chamber, although the mechanism is clearly sturdy enough to withstand a good bit of debris.

Through experimentation it has been found that the invention provides a method of firing an industrial 8 gauge kiln gun by which a single operator can point the gun into a kiln, and load and fire the gun repetitively into the kiln at a rate in excess of 1 shell per six seconds over a period in excess of 1 minute. The gun can generally be mounted in a fixed position and the rotation of the kiln used to move the target into the proper position for firing.

While the invention has been described above and below with references to preferred embodiments and specific examples, it is apparent that many changes, modifications and variations in the materials, arrangements of parts and steps can be made without departing from the inventive concept disclosed herein. Accordingly, the spirit and broad scope of the appended claims is intended to embrace all such changes, modifications and variations that may occur to one of skill in the art upon a reading of the disclosure.

IN THE CLAIMS:

1. An autofiring mechanism for an industrial gun (10) of the type having a rotary falling breech block (18) lowered and raised by a handle, characterized by:

means (20) connected (36) to the handle for firing the gun (10) in response to a movement of the handle in the direction for raising the block (18) to a position beyond that for fully raising the block (18).

2. The mechanism of claim 1 characterized in that a rotary cocking cam (16) attached to the handle is movable in a first direction (76) to cock the gun (10) and lower the breech block (18) and in a second direction (66) to raise the breech block (18).

3. The mechanism of claim 2 characterized in that the means (20) comprises a puller means (36) connecting the cam (16) to a trigger (34), the puller means (36) being rigid in tension and flexible in compression.

4. The mechanism of claim 3 characterized in that the puller means is a chain (36).

5. The mechanism of claim 4 characterized in that the puller means (36) further comprises an adjustment means (38) for selectively adjusting the length of the puller means (36).

6. The mechanism of claim 1 characterized in that the mechanism has means (20) responsive to forward movement of the handle to fire the gun (10).

7. A method of firing an industrial shotgun (10) characterized by the steps of:

(a) loading an unfired shotshell (48) into a chamber (52) of the gun (10),

(b) making a first movement of a handle in a first direction (66) from a first position to a second position,

(c) automatically fully closing the breech (18) of the gun (10) in response to the first movement,

(d) making a second further movement of the handle in the first direction (66) to a third position,

(e) automatically firing the unfired shotshell (48) in response to the second movement,

(d) making a third movement of the handle in a direction (76) different than the first direction (66) to a fourth position, and

(e) automatically opening the breech (18) of the gun in response to the third movement, and

(f) removing the fired shotshell (48) from the chamber (52).

8. The method of claim 7 characterized in that the fourth position is identical to the first position, thereby simplifying repetitive operation.

9. The method of claim 8 characterized in that steps (a) through (e) are repeated a second time.

10. The method of claim 9 characterized in that the first and second movements are rotational.

11. The method of claim 9 characterized in that the third movement is rotational.

12. The method of claim 9 characterized in that the shotshell (48) is an 8 gauge industrial slug-type shotshell (48).

13. The method of claim 9 characterized in that the gun (10) is pointed into a rotary kiln prior to the second movement and conducting the second movement while the gun (10 is pointing into the kiln.

14. The method of claim 7 characterized in that the loading and unloading are done with one hand and the first, second and third movements are done with the other hand all by a single person.

15. A method of firing an industrial 8 gauge kiln gun (10) characterized by the steps of:

(a) pointing the gun (10) into a kiln, and

(b) one person alone loading and firing the gun repetitively into the kiln at a rate in excess of 1 shell per six seconds over a period in excess of 1 minute.

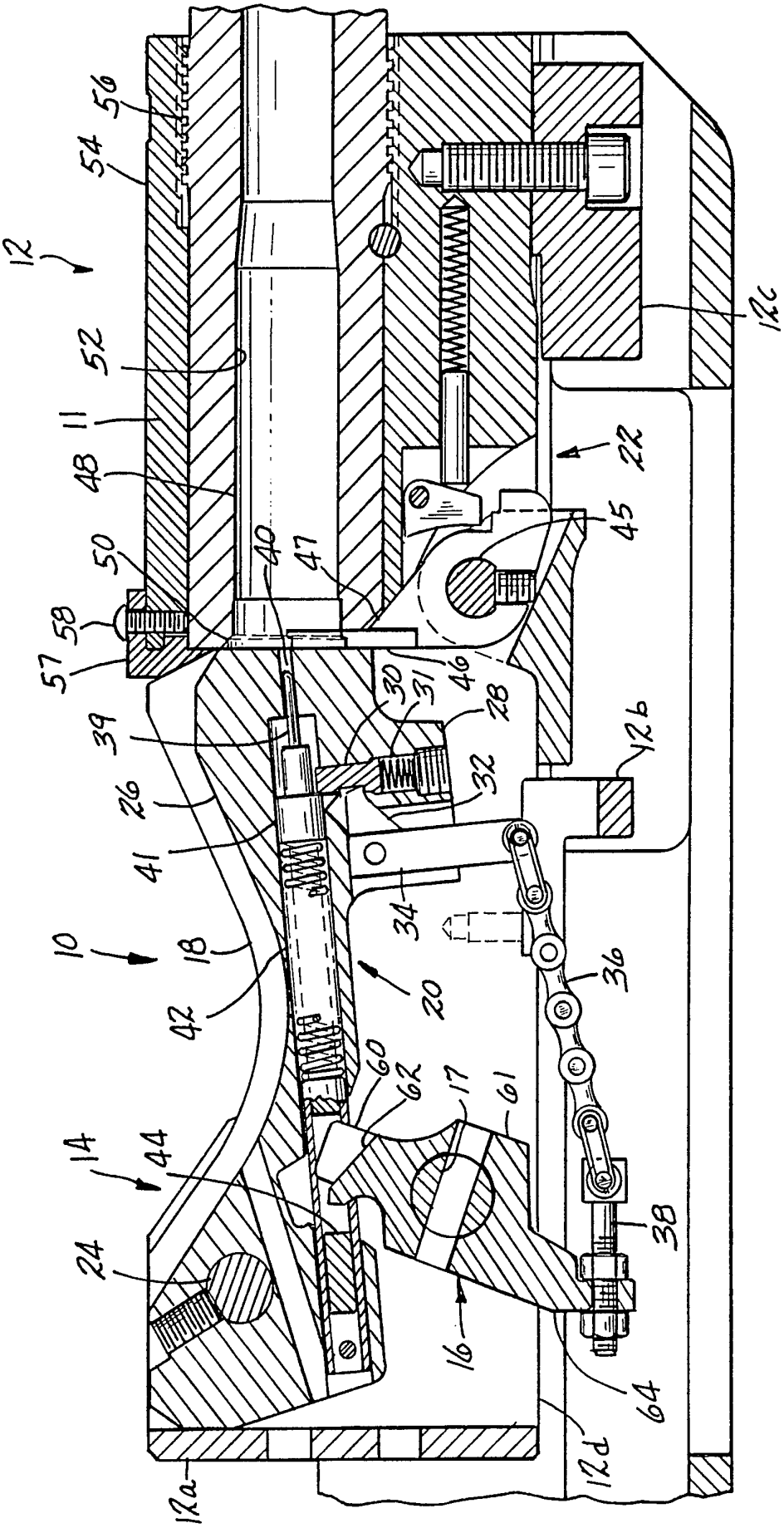
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FIG-1

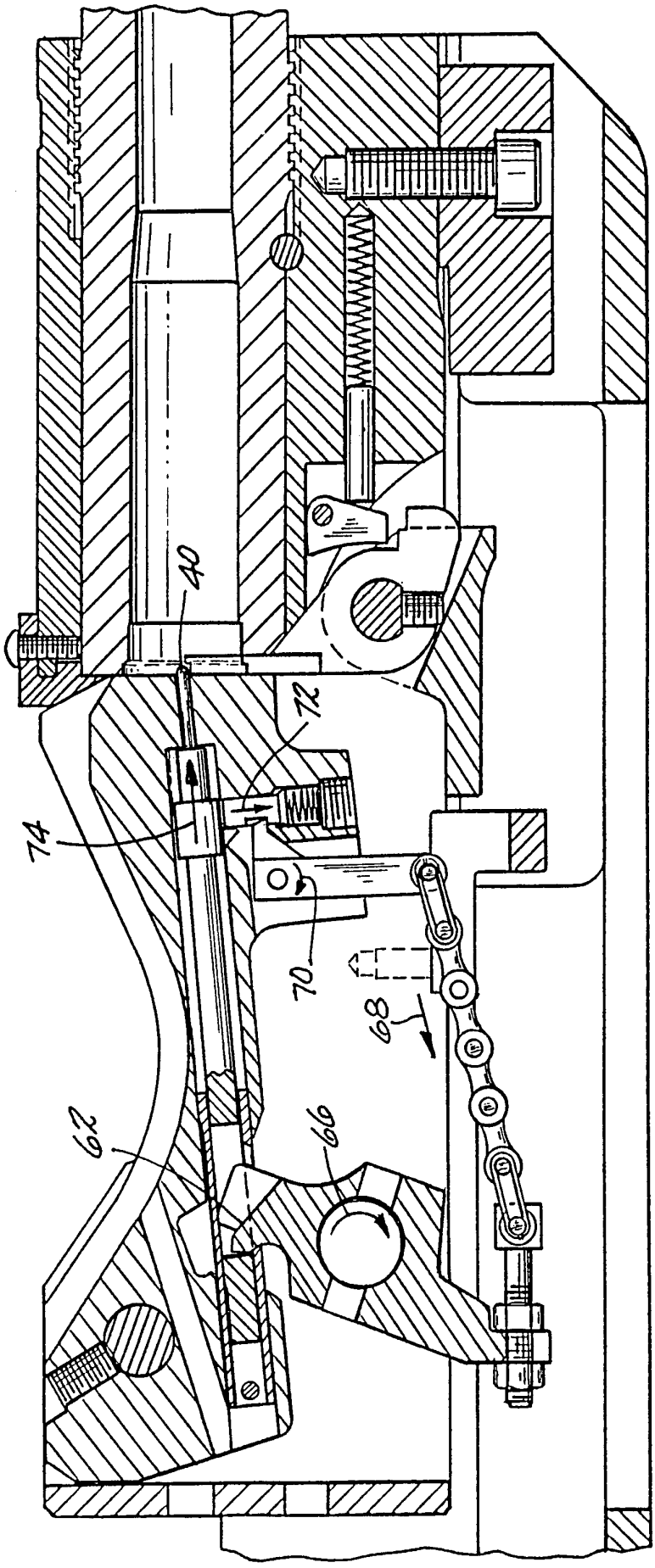

FIG-2

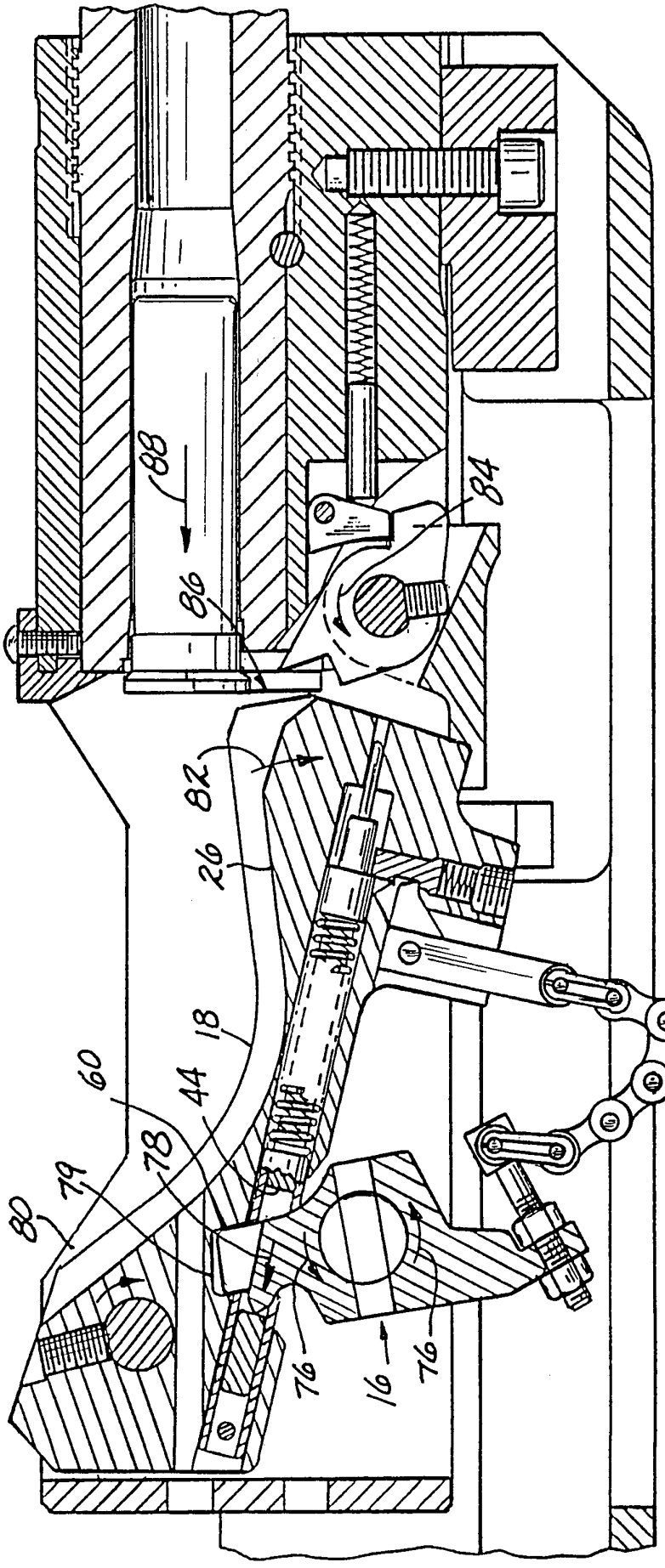

FIG-3

INTERNATIONAL SEARCH REPORT

Ir. ıational application No.
PCT/US93/11176

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :F41A 3/06
US CL :89/25, 27.11

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 42/26, 28, 29; 89/25, 27.11, 27.30, 149

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US, A, 202,126 (Sneider) 09 April 1878, see lines 16-10 from the end of the first column.	1, 7-11 --------- 12-15
X -- Y	US, A, 445,880 (Warnant-Creon) 03 February 1891, see page 1, lines 101-102, and page 2, lines 11-21 and 103-106.	1-2, 7-11 ---------- 12-13, 15
X	US, A, 3,507,184 (Prybyla) 21 April 1970, see column 6, lines 13-18.	15
X	US, A 4,341,031 (Palmer et al) 27 July 1982, see lines 1-4 and 7-11 of the ABSTRACT and column 3, lines 17-23.	7-15

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4,444,088 (Olson) 24 April 1984, see lines 1-4 of the ABSTRACT and column 2, lines 20-21.	1-2, 6-15
X	US, A, 4,986,019 (Dennis, Jr.) 22 January 1991, see column 6, lines 53-54.	15
X -- Y	DE, A, 684,146 (Walther) 23 November 1939, see page 2, lines 44-66.	1-2, 6-11 --- 12-15
A	US, A, 493,987 (Driggs) 21 March 1893, see page 1, lines 73-76.	4