

[54] **DEVICE FOR FEEDING AN EXPLOSION GENERATOR WITH EXPLOSIVE CHARGES**

3,526,325 9/1970 Temple214/16.4 R

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[57] **ABSTRACT**

[22] Filed: **Oct. 9, 1970**

Device for feeding explosive cartridges to a charging tube of an explosion generator wherein said cartridges are stored, each in a compartment of a magazine displaceable along a slideway so that successively each compartment registers with a hole in the slideway in line with the opening of the charging tube and comprising a reciprocating shaft actuated through a crank and a connecting rod and solid with a catch adapted to come into engagement with recesses provided at the base of the magazine, a rocking lever with pawls adapted to block the magazine by engagement with a recess thereof and a connecting rod with a longitudinal slot connecting said rocking lever to said shaft only towards the end of the backward stroke of the latter.

[21] Appl. No.: **79,450**

[30] **Foreign Application Priority Data**

Oct. 10, 1969 France6934910

[52] U.S. Cl.**221/82, 89/33 B, 214/16.4 R**

[51] Int. Cl.**B65g 47/06**

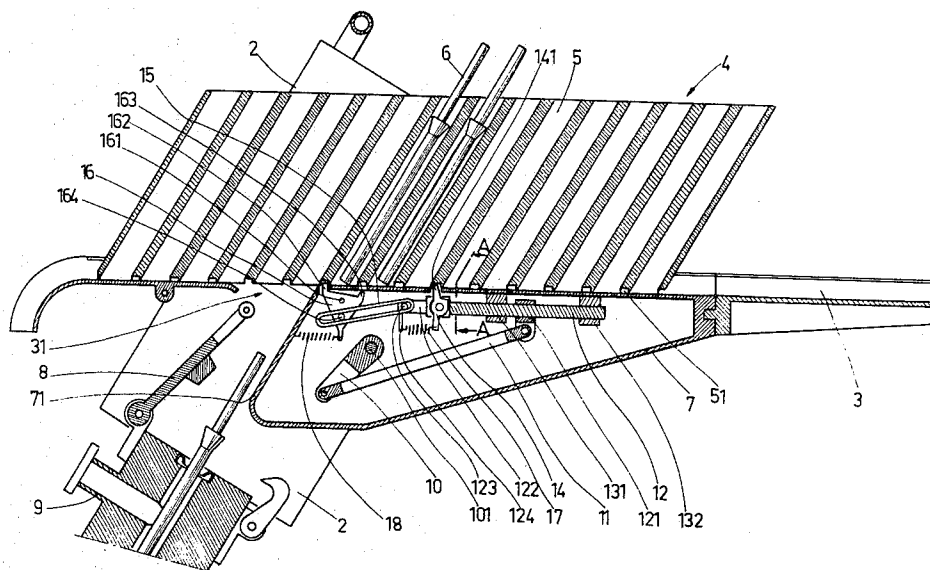
[58] Field of Search.....221/82, 83; 214/16.4 R; 89/33 B

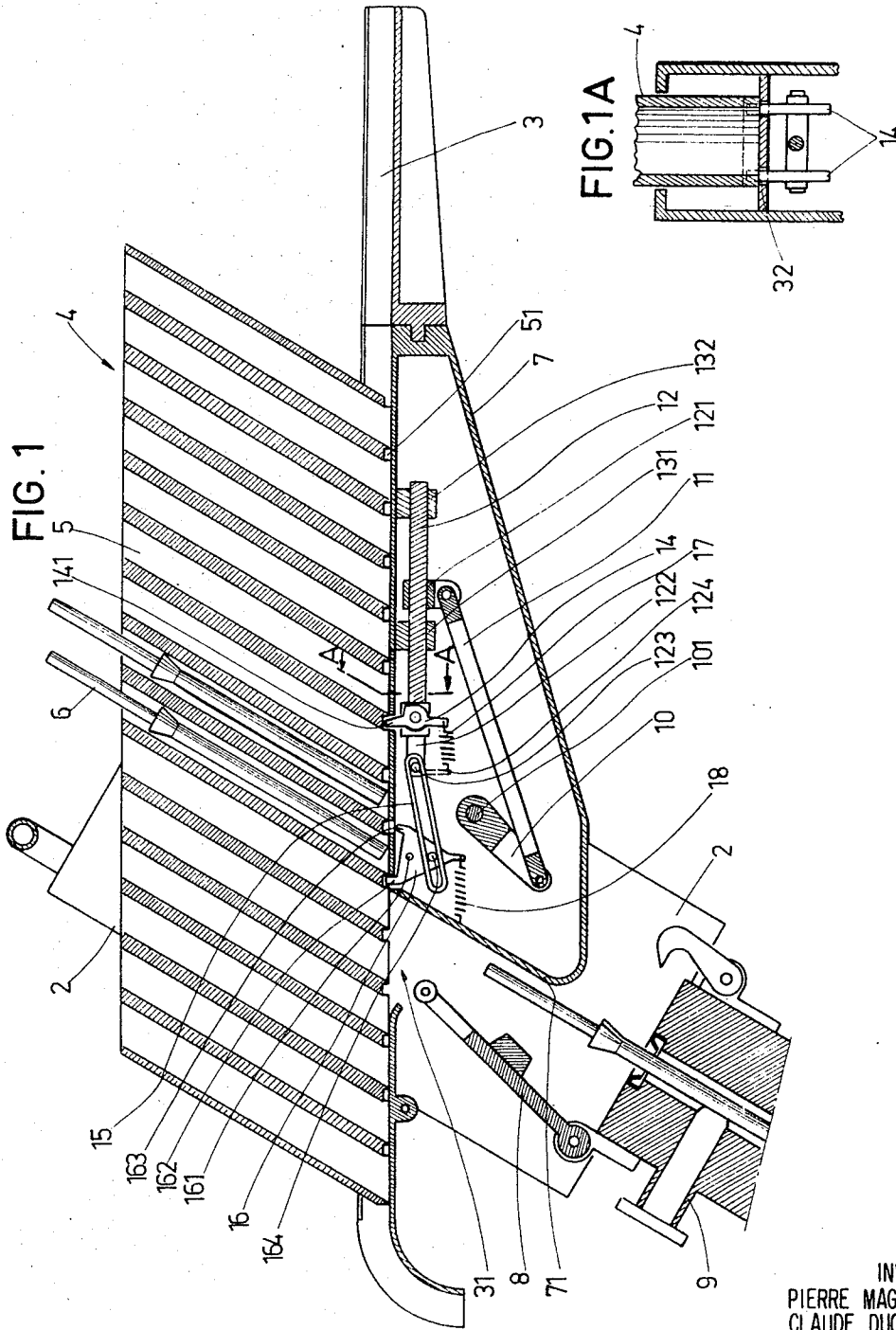
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7 Claims, 7 Drawing Figures

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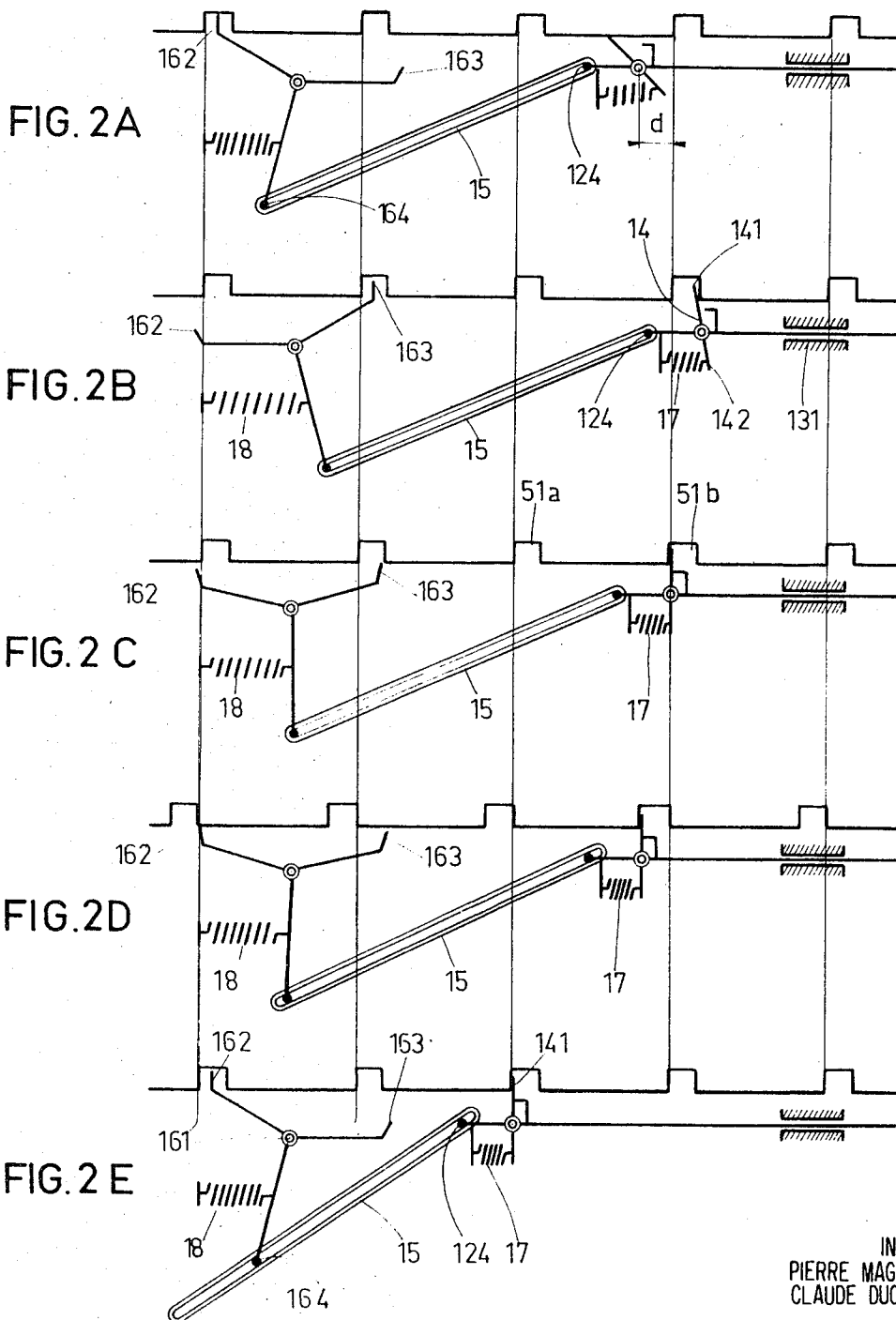




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DEVICE FOR FEEDING AN EXPLOSION GENERATOR WITH EXPLOSIVE CHARGES

This invention relates to a device for feeding with explosive charges the charging tube of an explosion generator.

The device of the invention may, by way of example, relate more particularly to a sub-marine explosion generator system used for carrying out marine seismic prospecting by exploding small immersed charges.

This system comprises essentially a charging tube having one immersed end and comprising a system for receiving and detonating the explosive charges, the other end of said charging tube being provided with a device for feeding and loading the explosive charges, placed on a surface installation. Such a device, illustrating the prior art of this invention, is described in U.S. Pat. No. 3,368,641.

The loading apparatus comprises a cartridge magazine formed by the immersed end of the charging tube. The cartridges are distributed through a slide valve system.

It is an object of this invention to provide a new device for feeding an explosion generator with explosive cartridges which offers, as compared to the preceding one, the advantage of a great simplicity of design, of being very easy to realize and of a very steady and smoothly working.

This device further comprises a system for displacing and driving a cartridge magazine, provided with a blocking system having the advantage of fixing in position the magazine when the same is subjected to unexpected movements.

This device essentially comprises a cartridge magazine and an automatic system providing for the steady advance of the magazine and the conveyance of the cartridges towards the charging tube.

The invention will be described more in detail in a non-limitative manner with reference to the accompanying drawings wherein:

FIG. 1 is a diagrammatic cross-sectional view of the device of the invention,

FIG. 1 A diagrammatically shows a detailed cross-sectional view along line A—A of the cartridge magazine with a slideway and a driving catch; and

FIGS. 2A, 2B, 2C, 2D and 2E diagrammatically illustrate the working of the apparatus with the various steps of back and forward motion of the cartridge magazine.

The device illustrated in FIGS. 1 and 1A comprises charging tube 1, only one end of which is shown.

This tube is extended with a hollow member 2. In this hollow member is moulded a slideway 3 on which slides a cartridge magazine 4.

This magazine comprises a body traversed by alveoles formed of tubular channels 5. These channels are extending with their axes substantially parallel to the loading tube 1 and their openings are substantially in line with an axis parallel to the slideway 3.

The angle between the axis of the slideway 3 and that of tube 1 may be different from that shown by way of illustration in FIG. 1. Irrespective of the selected value of said angle, the magazine 4 has to be provided with tubular channels whose axes are substantially parallel to the loading tube axis.

Recesses 51 are provided at regular intervals on the side of the magazine which is bearing on the slideway 3. Such recesses are extending over the whole width of the magazine 4 in a direction perpendicular to its axis.

The magazine 4 is filled with cartridges placed with their base in abutment against the slideway 3.

A port hole 31 is arranged in the latter, close to the extension of the axis of tube 1. This port hole is large enough for the passage of the cartridge 6 therethrough.

The slideway 3 comprises, on the side opposite to that on which the magazine takes it bearing, a cover 7 containing the magazine driving mechanism which will be described hereinafter.

The cover 7 comprises a wall 71 the upper end of which takes its bearing on a portion of the circumference of the port hole 31. The direction of said wall is substantially parallel to the axis of tube 1 and to the channels 5. By this way it forms a

guide for the cartridges sliding from their storage channels towards the opening of the charging tube.

The end of tube 1 is provided with a closing gate 8. Through a lateral duct 9, opening in the conveying conduit inside the tube, there may be introduced a fluid for propelling the cartridges towards the explosion generator located at the other end of tube 1.

Sequential operations of opening and closing gate 8 and introducing fluid may be carried out, for example, by use of the device described in the U.S. Pat. No. 3,439,577.

The device is actuated by means of a driving mechanism essentially comprising a shaft 12 longitudinally displaceable, provided with catches 14 controlling the longitudinal displacement of the magazine and swinging rockers 16 for blocking the magazine in the stop positions.

The shaft 12 is guided in two bearings 131 and 132 secured on the slideway and moves in a direction parallel thereto. On a sleeve 121 solid with the shaft 12, is articulated an assembly formed of connecting rod 11 and crank 10. The rotation of a shaft 101 solid with crank 10 drives the shaft 12 in a reciprocating linear motion through the intermediary of the connecting rod 11.

The shaft 12 is extended at one end thereof by a fork with two arms 122 symmetrical with respect to the longitudinal axis of the magazine 4 and whose spacing is smaller than the width of the body of magazine 4 (FIG. 1 B). To each of these arms 122 is secured a catch 14. The end parts 141 of both catches may come into engagement with the recesses 51 through two port holes 32 (FIG. 1A) arranged in the slideway 3, in a direction parallel to its axis, symmetrically with respect to magazine 4 and over a length at least equal to the distance between two adjacent recesses 51.

To the end parts of the arms of fork 122 are secured two pins 123 and two lugs 124. Two return springs 17 connect the lugs 124 to the catches. Two tappets (not shown) prevent the rotation of the catches 14 except in the direction corresponding to the stretching of the springs 17.

Two swinging rockers 16 are mounted on axis 161 perpendicular to the slideway axis. Their spacing is substantially the same as the lateral spacing between the two catches 14. The axis 161 is so placed that the two pawls 162 and 163 of each rocker register with two adjacent recesses 51.

The slideway is so designed that a recess 51 is provided in front of each pawl 162 and 163 so that any one of them may come into engagement with the recess facing it.

Two springs 18 connect the rockers 16 to the wall 71 of cover 7. When the spring is at rest, the pawls 162 are engaged in the recesses of the slideway and prevent any unexpected back motion of the magazine. A pin 164 is fastened to each rocker on the other side of axis 161 with respect to the pawls.

Finally each rocker 16 is connected through a movable coupling to one of the arms of fork 122. This coupling is achieved by sliding of each of the two pairs of pins 123 and 164 inside a slot provided in the connecting rod 15 along its longitudinal axis. The length of said slot will be defined later when explaining the operation of the device.

In the above-described preferred embodiment, the displacement and the blocking of magazine 4 are provided by means of an assembly formed of two catches 14, two rockers 16 symmetrical with respect to the magazine longitudinal axis and recesses 51 placed at regular intervals. This symmetrical arrangement makes possible a regular drive.

The working of the device as illustrated in FIGS. 2A, 2B, 2C, 2D and 2E makes apparent, in particular, the advantages of the system for anchoring the magazine which prevents any inopportune movement during the successive stages of operation.

For sake of clarity the catch 14 and the rocker 16 are shown with a simplified representation. The castellated lines show the lower surface of the magazine provided with its recesses 51.

On FIG. 2E the control system is in a rest position identical to that of FIG. 1. The spring 18 is released, the pawl 162 is engaged in the recess 51 and blocks the magazine 4.

The crank 10 is then rotated so that the sleeve 121, driving the shaft 12 moves away from the bearing 131. The catch 14 pivots and its end part 141 slides on the corresponding surface of magazine 4. The length of the slot of the connecting rod 15 is so designed that, when the rotation axis of the catch 14 is at small distance d of the edge of the next recess 51b, the pin 164 comes in abutment against the end thereof. The back motion is then continued to a sufficient extent so that the end part 141 of the catch comes into engagement with recess 51b (FIG. 2B). During this further back motion, the rocker 16, driven by the connecting rod 15, pivots and its pawl 163 enters the recess facing it, thereby preventing any premature forward movement of the magazine. The back motion stage is thus terminated.

The shaft 12 is then displaced in the opposite direction. In the position illustrated in FIG. 2C the catch is again in a position of engagement with recess 51b, for driving the magazine 4. The rocker 16 is returned to its rest position by means of spring 18 and the pawl 163 is almost completely disengaged from the recess facing it.

The forward movement is continued and the catch 14, in abutment against the bottom of recess 51 b, drives along the magazine. The return spring 18 makes the rocker 16 to pivot.

When the rocker is again at its rest position (spring 18 released) the pawl 162 is no longer registering with a recess of the magazine as a result of the displacement of the latter. This pawl then slides on the surface of the magazine without interrupting the forward movement thereof (FIG. 2D). In order to facilitate such sliding, the pawl will be given advantageously a round surface.

At the end of the return stroke the magazine has advanced by a distance equal to the interval between two adjacent recesses 51, a channel 5 has been substituted for another at the position facing the loading port of tube 1 and the pawl 162 of rocking lever 16 is engaged in a recess 51 (FIG. 2E).

It is observed that the rockers 16 prevent any unforeseeable movement of the magazine 4, which might happen as a result of a wrong actuation or an inopportune thrust exerted directly thereon. Such system thus ensures a perfect security.

The magazine 4 must besides be removable from the slideway for the case of interruption of the shots. The corresponding withdrawal motion must be effected in the direction towards the rear side of the magazine so as to avoid that the cartridges fall successively through port hole 31. This withdrawal is made by hand. The shaft 12 is pushed back to the position shown in FIG. 2B wherein the pawl 163 is engaged and blocks any forward motion of the magazine. The withdrawal is then achieved by manually pivoting the catch 14 so as to completely disengage the same from its recess and sliding backwardly the magazine 4.

During the stage of advancing the magazine, the gate 8 is open. The cartridge 6, housed in the channel facing the loading port at the end of the stroke, is released, slides on surface 71 and falls in the internal conduit of tube 1. The operation of gate 8 may be controlled automatically. In this case the gate actuating device will be advantageously associated to the device for controlling the forward displacement of magazine 4.

The above described device constitutes only a non-limitative embodiment of the invention and modifications can be made thereto without departing from the scope thereof.

For example the catches 14 may be fixed on surface portions, parallel to the slideway, of a member secured on shaft 12 or on the shaft itself.

For the same reasons the shape of the connecting rod 15 which can be used is not limited to that shown in FIG. 1. More generally there can be provided in said connecting rod at least one slot wherein at least one of the pins 123 and 164 will slide.

The movement of the driving system may also be imparted by a piston whose rod is connected for example to the articulation axis of the connecting rod 11 with the crank 10.

In a variant of the driving mechanism the magazine is moved while spacing the two arms of the fork 122 so that the

two catches 14 be on both sides of the magazine and take their bearing on two rows of lugs parallel to the slideway axis and placed at regular intervals, each equal to the spacing between two adjacent recesses 51.

In a less advantageous embodiment there can be used a single catch 14 and a single rocker 16. The catch 14 will then press on the bottom of recesses 51 or will take its bearing on a single row of lugs, provided on one of the lateral faces.

The few non-limitative variants above mentioned may be used separately or in combination.

Moreover several cartridge magazines may be used according to the invention for feeding several charging tubes simultaneously or successively with convenient time lags. There could be used in such a case a single order for actuating the whole assembly.

It is therefore apparent that this invention has by no way to be limited to or circumscribed by the specific features details or conditions herein specified since various changes and modifications of the invention can be made to adapt it to various usages and conditions without departing from the spirit thereof. Consequently such changes and modifications are properly, equitably and intended to be within the full range of equivalence of the appended claims.

What we claim is:

1. A device for feeding with explosive charges at least one explosion generator comprising at least one storage magazine for the charges provided with compartments at least one slideway on which the magazine is slidably mounted and on the surface of which open said compartments, said slideway being provided with a port hole for communication between one of said compartments of each magazine and a charging tube, remarkable in that the magazine is actuated by a driving mechanism comprising a shaft, means for longitudinal reciprocating displacement of said shaft, at least one catch mounted on said shaft, rotatable in only one direction from an equilibrium position and provided with means for returning to said position, means for driving said magazine, by action on said catch, only in forward direction, a system for blocking the magazine in position during the stop periods between the periods of displacement thereof, and means for intermittently connecting said blocking system to said shaft in a single direction of displacement of the latter.

2. A device according to claim 1, wherein the driving means comprises recesses provided at regular intervals in the face of the magazine resting on the slideway, and adapted for engagement of said catch.

3. A device according to claim 1 wherein the driving means comprises at least one row of lugs provided at regular intervals on the face of the magazine and forming abutments for the catch.

4. A device according to claim 1, wherein the system for blocking the magazine comprises a swinging rocker provided with blocking pawls adapted to come into engagement with the recesses provided at regular intervals in the face of the magazine resting on the slideway.

5. A device according to claim 1 wherein said means for connecting the blocking system to the shaft comprises at least one pair of pins secured, one on the blocking system, the other to the shaft, and at least one connecting rod, in which is cut off at least one slot of a length greater than the distance between said pins, forming a housing for at least one of them.

6. A device according to claim 1, wherein said means for displacement of said shaft comprises a connecting rod and a crank, connecting said shaft to reciprocating thrust means.

7. A device according to claim 4, wherein said means for connecting each swinging rocker to the shaft comprises one pair of pins fixed, one on the swinging rocker, the other to said shaft, and one connecting rod in which is cut off at least one slot of a length greater than the distance between said pins, forming a housing for at least one of them, the displacement stroke of the pins inside the slot of the connecting rod being smaller than the distance between two adjacent recesses.

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