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RELEASE MECHANISM FOR IMPACT SEISMIC IMPULSE GENERATING APPARATUS

Filed July 12, 1963

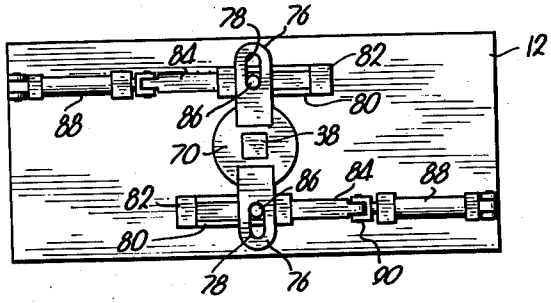


Fig.2.

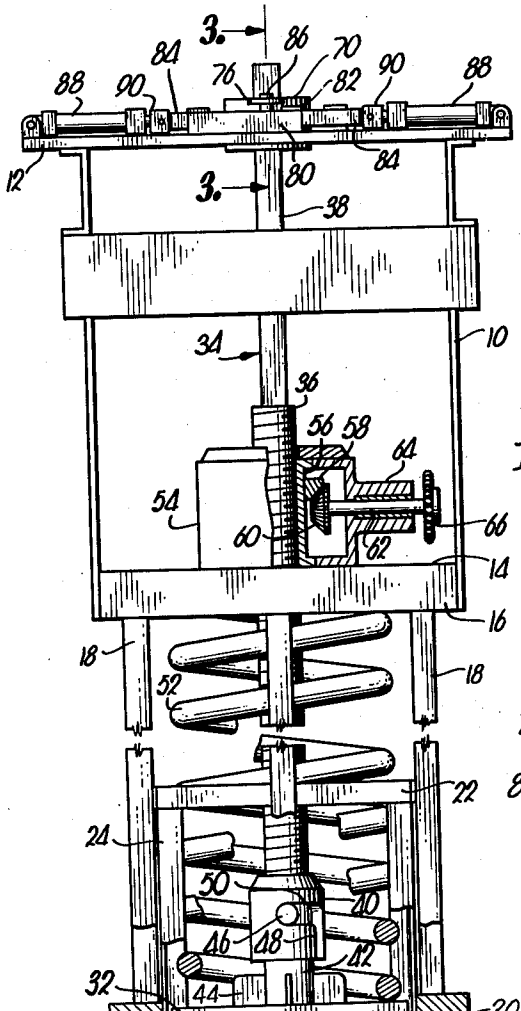


Fig.1.

Fig.4.

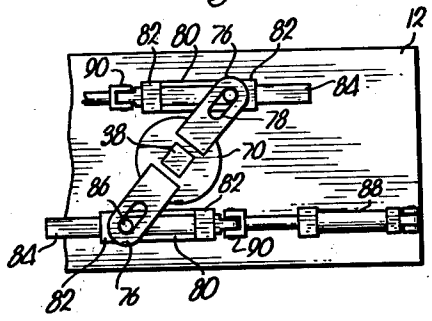
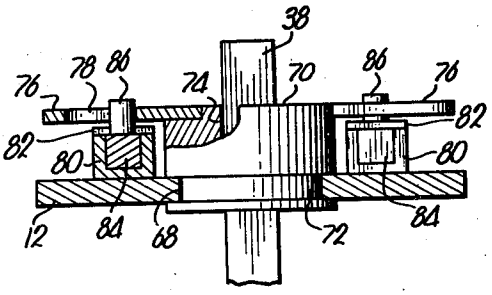


Fig.3.



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RELEASE MECHANISM FOR IMPACT SEISMIC IMPULSE GENERATING APPARATUS

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This invention relates to improvements in release mechanism for impact seismic impulse generating apparatus of the type shown and described in my copending patent application entitled "Impact Apparatus For Generating A Sonic Impulse Employed In Seismic Geological Exploration," Serial No. 75,346, filed December 12, 1960.

In seismic geological studies the seismic impulse has heretofore been produced by the detonation of explosives or by dropping a heavy weight on the ground. This latter method of producing a seismic impulse has many desirable attributes as compared with the detonation method, but inherent disadvantages are also prevalent. The apparatus disclosed in the aforesaid copending patent application provides improved means for generating sonic impulses which is not subject to the disadvantages inherent in the weight-dropping method.

The instant invention is directed to improvements in apparatus of the type shown and described in the aforesaid patent application. Specifically, this invention deals with the problem of releasing the hammer to permit the same to strike the anvil and thereby produce the seismic impulse. Although the release mechanism shown and described in the aforesaid patent application is highly satisfactory, it is bulky and relatively complex as compared with the structure to be hereinafter described.

It is, therefore, the primary object of this invention to provide a relatively simple and compact release mechanism for the hammer of sonic impulse generating impact apparatus.

It is another object of this invention to provide release mechanism for use with impact apparatus of the type shown and described in the aforesaid patent application which eliminates the need for clutch plates.

It is still another object of this invention to provide release mechanism for sonic impulse generating impact apparatus which will permit reciprocal movement of the hammer with respect to the anvil of the apparatus and yet be operable to rotate the hammer with respect to the anvil against the forces exerted by the hammer accelerating spring to release the hammer and permit the same to be accelerated into impactive contact with the anvil.

Other objects will become apparent as the detailed description proceeds.

In the drawing:

FIGURE 1 is a view of the impact apparatus of the instant invention partially in section and partially in elevation with parts broken away for clarity showing the apparatus in its operative position on the ground surface;

FIG. 2 is a top view of the apparatus shown in FIG. 1 revealing the release mechanism of the instant invention;

FIG. 3 is a sectional view taken along line 3—3 of FIG. 1 with certain components shown in elevation for clarity; and

FIG. 4 is a fragmentary, top view similar to FIG. 2 but showing the release mechanism in its actuated position.

Referring to the figures, the numeral 10 designates a generally rectangular frame. Frame 10 is employed as a support for the various components of the apparatus and includes an upper, horizontal plate 12 and a lower, horizontal plate 14. Plate 14 is provided with a depending flange 16 around its periphery. Frame 10 may be carried by a truck or other vehicle to render the apparatus mobile and is placed in the disposition shown when it is desired to operate the apparatus.

Four support members 18 depend from plate 14 and are interconnected at their lower ends by a rectangular cage 20. Crosspieces 22 are employed between the ends of members 18 to increase the structural rigidity of the frame assembly. Four vertical angle members 24 depend from crosspieces 22 and define the corners of a rectangle.

An anvil or ground plate 26 is placed upon the surface of the ground during operation of the apparatus and supports the frame assembly through the use of spacers 28 disposed between cage 20 and anvil 26. A hammer 30 is shown at rest in engaging relationship with anvil 26, the hammer being provided with a rectangular plate 32 on its upper surface. The corners of plate 32 are closely spaced from and mate with the corners of vertical angle members 24; it will be appreciated that members 24 serve as guides for hammer 30 during reciprocation thereof to prevent lateral movement of the hammer.

A vertical shaft 34 extends centrally through the impact apparatus and is provided with a lower, exteriorly threaded portion 36 and an upper, transversely rectangular portion 38. Portion 36 is provided at its terminal end with a coupling 40 in the form of a sleeve. An upstanding shaft 42 rigid with the central portion of hammer 30 is telescoped within coupling 40. Ribs 44 are employed to assure a rigid connection between shaft 42 and hammer 30, it being understood that hammer 30, plate 32, and shaft 42 are secured together to form a solid unit of large mass.

A stud 46 extends laterally from shaft 42 and is received by a vertical slot 48 and a horizontal slot 50 in sleeve 40, slots 48 and 50 being communicated as shown to form a right-angle configuration. When shaft 34 is disposed such that slot 48 is aligned with stud 46, downward movement of shaft 34 permits stud 46 to slide upwardly along slot 48, whereupon subsequent rotational movement of shaft 34 moves stud 46 along slot 50 thereby connecting hammer 30 to the shaft.

A coil spring 52 bears against the upper surface of plate 32 and the lower surface of plate 14. Spring 52 is compressed when shaft 34 is shifted longitudinally upwardly. Hammer 30 is accelerated by spring 52 into impactive engagement with anvil 26 during operation of the apparatus.

A housing 54 is mounted on plate 14. Housing 54 has a central opening therethrough receiving threaded portion 36 of shaft 34. Within the housing and in surrounding relationship to portion 36, a sleeve 56 is disposed, the sleeve being internally threaded to mate with the external threads of portion 36. Sleeve 56 is rotatably carried by housing 54 for rotational movement about the longitudinal axis of shaft 34. A ring gear 58 is rigid with sleeve 56 and mates with a bevel gear 60. Bevel gear 60 is rigid with the end of a driven shaft 62 which is journalled in a boss 64 extending from housing 54.

The end of driven shaft 62 remote from bevel gear 60 is provided with a sprocket wheel 66. A chain drive (not shown) is coupled with sprocket wheel 66 for rotating shaft 62 and bevel gear 60. Any suitable power source may be used for the chain drive such as a power take-off on the vehicle carrying the impact apparatus.

Plate 12 has a central, circular opening 68 therethrough. A generally cylindrical element 70 has a cylindrical, reduced portion 72, the portion 72 being received by opening 68 to permit rotation of element 70 within opening 68.

Element 70 has a central passage 74 extending therethrough. Passage 74 slidably receives the transversely rectangular portion 38 of shaft 34. Therefore, it may be appreciated that shaft 34 is permitted to move longitudinally through element 70 but that the shaft is not permitted to rotate with respect to elements 70.

A pair of diametrically opposed, laterally extending ears 76 are rigidly secured to element 70. Each ear 76 is provided with a slot 78. The length of each slot 78 runs in directions perpendicular to the longitudinal axis of shaft 34.

A pair of elongated, rectilinear guides 80 are mounted on plate 12 on opposite sides of element 70. Each guide 80 is transversely U-shaped throughout its major length and is provided at its ends with plates 82 which render the guide transversely rectangular at each end.

Each guide 80 slidably receives an elongated member 84 of transversely rectangular configuration. A pin 86 extends transversely from each member 84 and is received by the slot 78 in a corresponding ear 76. One end of each member 84 is operably coupled with the piston rod of a double-acting, hydraulic cylinder 88 by means of a clevis 90. Cylinders 88 are mounted on plate 12 and are coupled with hydraulic lines (not shown).

Reference is made to the aforesaid copending patent application for a full and complete description of the function and operation of impact apparatuses of the type shown and described herein. Therefore, only such portions of the operation of the impact apparatus necessary for a full and complete understanding of the instant invention will be repeated in this specification.

FIGURES 2 and 4 show the two positions of the release mechanism. In FIG. 2 the hammer 30 is connected to shaft 34 by way of coupling 40 as shown in FIG. 1. In FIG. 4, however, element 70 is shifted in a clockwise direction by the hydraulic cylinders 88 to, in turn, rotate shaft 34 to a disposition aligning slot 48 with stud 46. Therefore, in the FIG. 4 position, hammer 30 is uncoupled from shaft 34 as is necessary when it is desired to accelerate the hammer under the action of spring 52 into impactive engagement with anvil 26.

The orientation of the components of the impact apparatus is as shown in FIG. 1 subsequent to impactive engagement of hammer 30 with anvil 26 and during nonuse of the apparatus or transportation thereof from one location to another. When it is desired to raise the hammer to compress spring 52, the chain drive coupled with sprocket wheel 66 is actuated to rotate shaft 62 and bevel gear 60. This effects rotation of ring gear 58 and sleeve 56 which, in turn, causes shaft 34 to be advanced vertically upwardly. Once hammer 30 reaches its maximum vertical position and spring 52 is fully compressed, hydraulic cylinders 88 are actuated to shift reciprocable members 84 in opposite directions. Actuation of hydraulic cylinders 88 forces element 70 to rotate clockwise as aforesaid, the pins 86 of reciprocable members 84 sliding in slots 78 of ears 76 until the members 84 reach the positions shown in FIG. 4 where the pins 86 are in abutting relationship with the plates 82 at the appropriate ends of the guides 80.

Manifestly, this effects rotation of shaft 34 to align slot 48 with stud 46 whereupon hammer 30 is uncoupled from the shaft and accelerated downwardly under the force of spring 52 into impactive engagement with anvil 26. When it is desired to reconnect hammer 30 with shaft 34, the chain drive coupled with sprocket wheel 66 is reversed and the release mechanism placed in the FIG. 4 position. After stud 46 is aligned with horizontal slot 50, shaft 34 is rotated by returning the release mechanism to the FIG. 2 position thereby reconnecting the hammer with the shaft.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In impact apparatus:
a shaft disposed for rotational movement about its longitudinal axis;
a hammer;
means on the hammer for releasably connecting the latter to said shaft, the shaft being rotatable with respect to said connecting means between a first position where the connecting means secures the hammer to the shaft and a second position where the hammer is uncoupled from the shaft;
a reciprocable member;
power means coupled with said member for shifting the latter between a pair of locations; and
structure operably coupling said member with said shaft to rotate the latter between said positions thereof in response to shifting of the member from one location thereof to the other location of the same.

2. The invention of claim 1, wherein said structure couples said member with the shaft at a point spaced laterally therefrom.

3. The invention of claim 1, wherein is provided a pin on said member extending therefrom, said structure including an ear operably coupled with the shaft and extending laterally therefrom, said ear having a slot therein slidably receiving said pin during shifting of the member.

4. The invention of claim 3, wherein said member is elongated and reciprocable longitudinally of the member, said pin extending laterally therefrom.

5. In impact apparatus:
a support;
a shaft;
structure receiving said shaft for longitudinal movement thereof with respect to the structure, said structure being mounted on said support for rotational movement with the shaft about the longitudinal axis of said shaft;
a hammer;
means on the hammer for releasably connecting the latter to one end of said shaft, the shaft and the structure being rotatable with respect to said connecting means between a first position where the connecting means secures the hammer to the shaft and a second position where the hammer is uncoupled from the shaft;
an elongated member mounted on said support for reciprocal movement longitudinally of the member;
a pin on the member extending laterally therefrom, said structure including an ear in laterally extending relationship to the longitudinal axis of said shaft, said ear having a slot therein slidably receiving said pin during movement of the member; and
power means mounted on said support and coupled with said member for shifting the latter between a pair of locations, whereby said shaft is rotated between said positions thereof in response to shifting of the member from one location thereof to the other location of the same.

6. The invention of claim 5, wherein said support includes a plate having a circular opening therethrough, said structure including a generally cylindrical element disposed in said opening and having a passage extending axially through the element receiving said shaft.

7. The invention of claim 6, wherein a portion of said shaft is transversely polygonal, said passage receiving said portion and mating therewith to prevent rotational movement of the shaft relative to said element.

8. The invention of claim 5, wherein is provided an elongated, rectilinear guide attached to said support and receiving said member for maintaining the latter in a rectilinear path of travel during movement of the member.

9. In impact apparatus:
a support including a plate having a circular opening therethrough;
a shaft, a portion thereof being transversely polygonal;
a generally cylindrical element disposed in said opening for rotational movement about the axis of the element, the latter having a passage axially therethrough slidably receiving said portion of the shaft for longitudinal movement thereof and mating therewith to prevent rotational movement of the shaft relative to said elements;

a pair of elongated members;

a pin on each of said members extending laterally therefrom;

a pair of parallel, elongated, rectilinear guides on said plate on opposed sides of said element, each of said guides receiving a corresponding member for reciprocal movement thereof along a rectilinear path of travel;

a pair of ears on said element in diametrically opposed relationship with one another, said ears extending from said element substantially perpendicularly to said axis thereof, each of the ears having a slot therein receiving a corresponding pin;

a hammer;

means on the hammer for releasably connecting the latter to one end of said shaft, the shaft and the element being rotatable with respect to said connecting means between a first position where the connecting means secures the hammer to the shaft and a second position where the hammer is uncoupled from the shaft;

power means mounted on said support and coupled with said members for shifting the members in opposite directions between a pair of locations, whereby said shaft and element are rotated between said positions thereof in response to shifting of said members from one location thereof to the other location of the same.

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