

Jan. 9, 1951

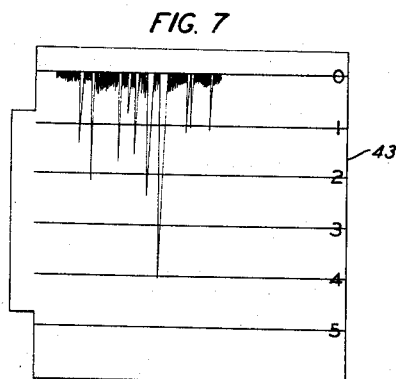
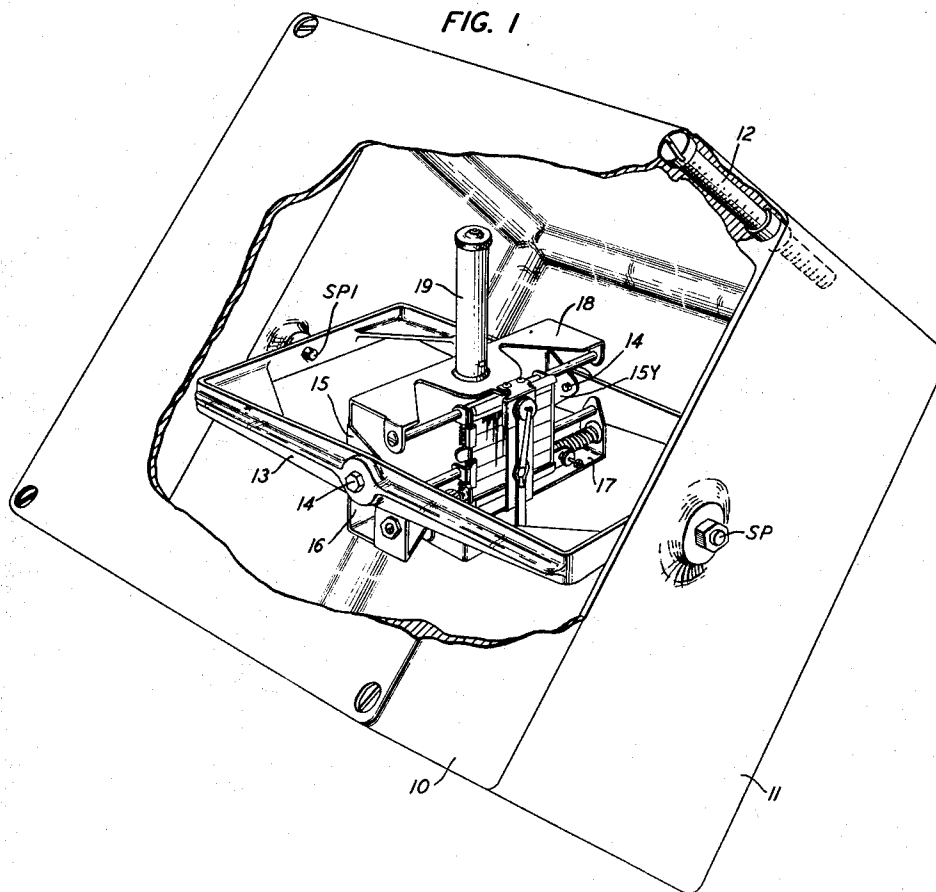
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2,537,858

IMPACT MEASURING AND RECORDING MECHANISM

Filed Oct. 25, 1947

3 Sheets-Sheet 1



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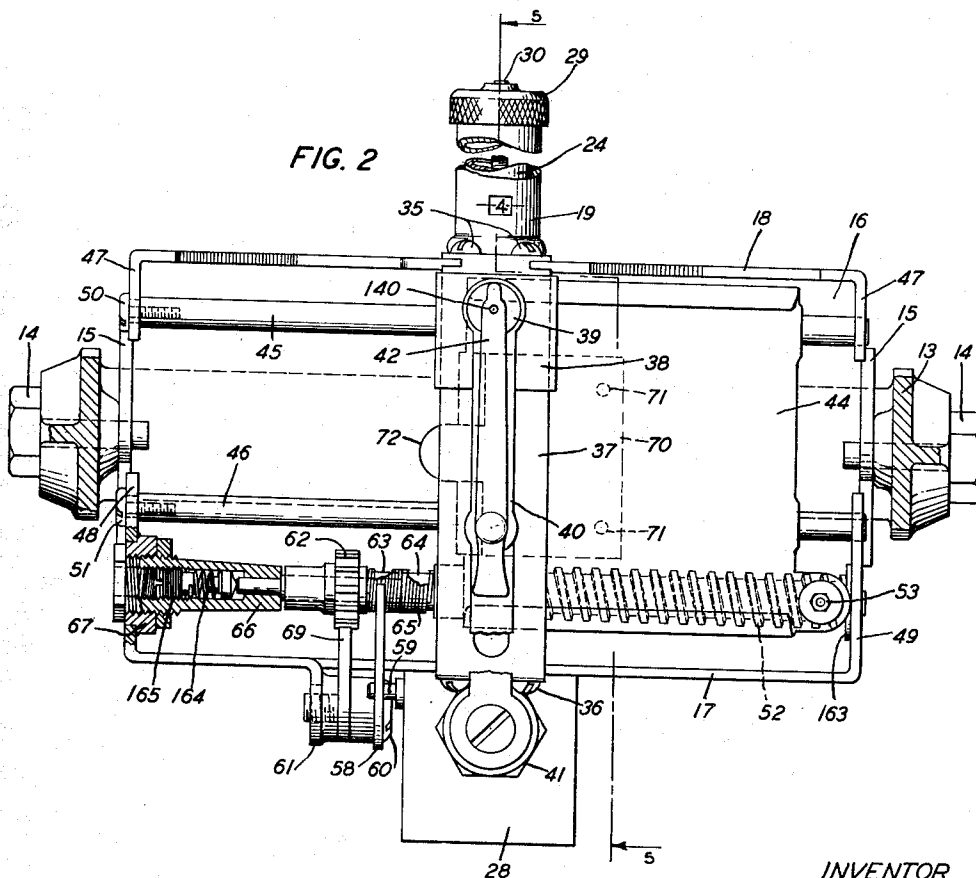
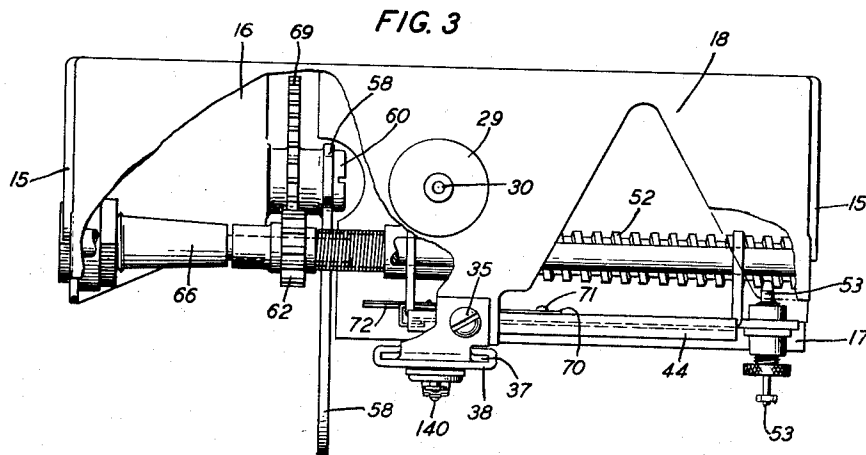
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3 Sheets-Sheet 2



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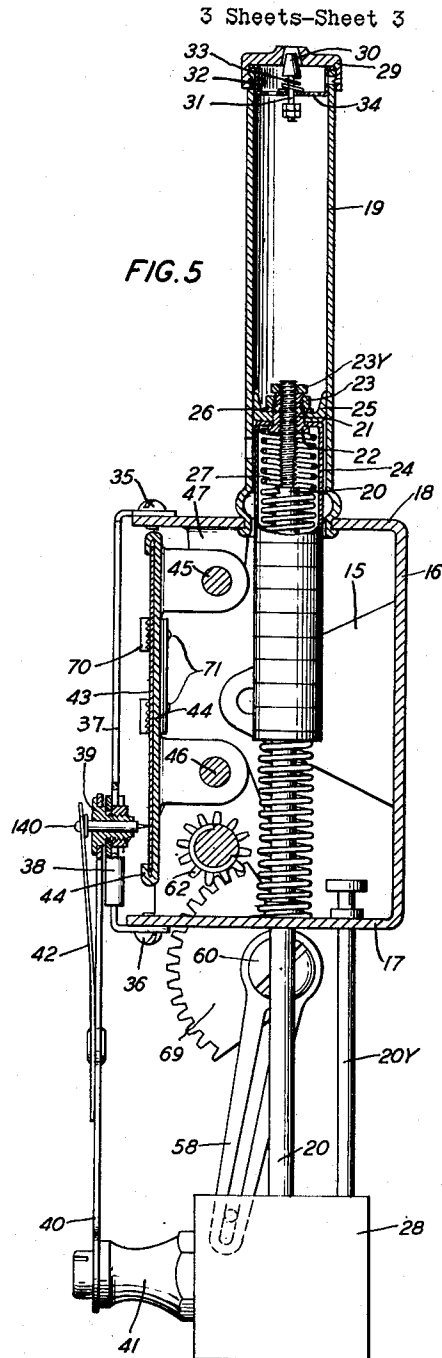
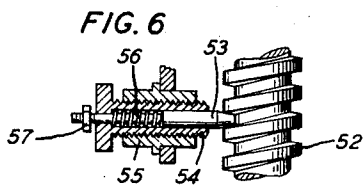
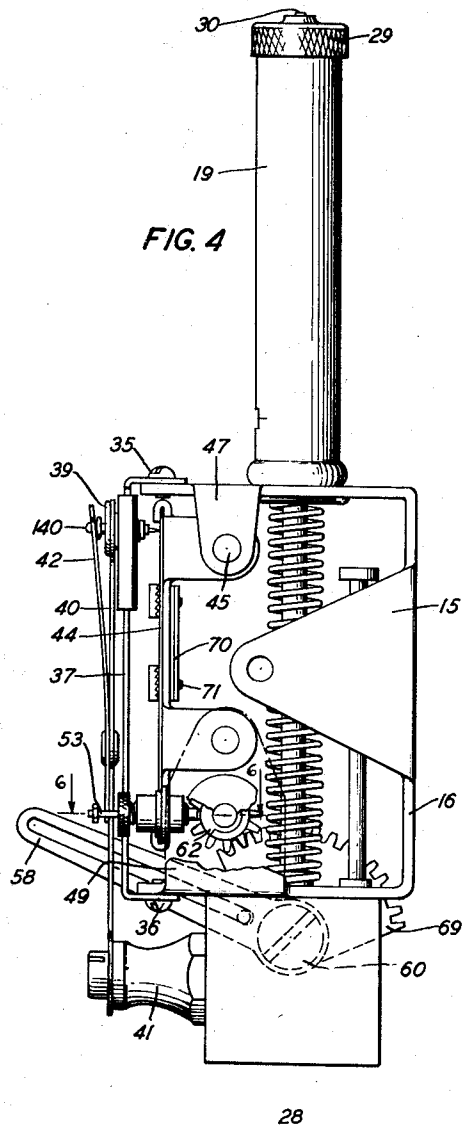
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IMPACT MEASURING AND RECORDING
MECHANISM

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5 Claims. (Cl. 346-7)

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This invention relates to impact measuring and recording apparatus.

The object of the present invention is the provision of an apparatus of the type above referred to, which records on a card the number of impacts packages containing fragile articles received while in transit and the number of times such packages are dropped in handling and the height from which such drops occur.

A feature of the invention is the provision of an impact responsive mechanism and means for recording on a card the successive operations of the impact responsive mechanism, means being provided for moving a holder for the card to a new position following each impact recording operation.

Another feature is the provision of means in the form of a clutch actuated by a combined lever and gear mechanism for imparting a unidirectional movement to means in the form of a lead screw in response to a two-way movement of the impact responsive means, the movement of the lead screw and of the holder for the card actuated thereby being intermittent and proportional to the operations of the impact responsive means.

Another feature is the provision of manually operable means carried by the card holder for disconnecting the latter from its actuating means for permitting the manual return of the holder to its starting recording position at the completion of each card recording operation, the disconnecting means operating automatically upon its release by the operator for reengaging its actuating means.

Another feature is the provision of pneumatic means operable for controlling the return movement of the impact responsive means to normal and thereby that of the movement of the holder for the card, the movement of the holder following each recording operation of the impact responsive means.

Another feature is the provision of means in the impact responsive means for adjusting the normal tension of a spring to a number of predetermined impact values as indicated by a scale set by the operation of the spring adjusting means.

Other novel features and advantages of the invention will appear from the following description and by the claims appended thereto, reference being had to the accompanying drawing in which:

Fig. 1 is an assembly view shown in perspective with the casing housing the operating mechanism shown with portions broken away;

Fig. 2 is a front view of the recording mechanism

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shown with the frame for the recording mechanism, mounting element and other operating parts in vertical section, the card holder being shown in starting recording position;

Fig. 3 is a top view of Fig. 2 showing the mounting element and a number of operating parts with portions broken away;

Fig. 4 is a right side view of the recording mechanism shown with a number of operating parts with portions broken away, the impact responsive mechanism being shown in normal position;

Fig. 5 is a view of the impact responsive and recording mechanism in vertical section taken on line 5-5 of Fig. 2, the impact and recording mechanism being shown partly operated;

Fig. 6 is a detail view showing the operative connection between the said holder and the lead screw, a number of operating parts being shown in section;

Fig. 7 is a facsimile of a card showing impacts recorded in actual service by the impact recording mechanism of this invention.

In the construction of the impact recording apparatus of this invention, a casing is formed of two sections 10 and 11 secured in assembled relation to each other by a plurality of bolts 12 as shown in Fig. 1. The casing section 11 is provided with two coaxially disposed spindle SP and SP1 serving for pivotally supporting the rectangularly-shaped frame 13, the latter in turn having two pivots 14 engaging drilled holes in lug members 15 and 15Y formed integrally with a mounting plate 16 as best seen in Figs. 1 and 3, thus permitting the universal movement of mounting plate 16 upon a change in the position of the casing formed by sections 10 and 11 above mentioned. The plate 16 is formed with two laterally extending flange portions 17 and 18, the latter having an opening at its middle length portion for receiving a cylinder in the form of a tubing 19 secured at one end to this flange as by expanding its circular edge as best seen in Fig. 5. A rod 20 has its lower disposed end fitted for sliding movement in a drilled hole in the flange portion 17 and the opposite end of this rod is screw-threaded for receiving a bushing 21 having a collar portion 22 and its opposite end screw-threaded for receiving a nut 23 serving for collectively clamping the end wall of a tubing 24, a piston in the form of an expansible leather washer 25 and a washer 26, the assembly thus formed being movable in tubing 19 for performing a function which will be hereinafter described in detail.

A coil spring 27 is disposed in concentric rela-

tion to rod 20 with one end abutting against the end wall of tubing 24 and its other end resting against the flange portion 17 of plate 16 to be compressed by the longitudinal downward movement of rod 24 under an impact received by a weight 28 secured to the lower disposed end of the rod 20, a rod 20Y carried by the weight 28 being provided to hold the latter against turning movement and to limit the movement of rod 20 and that of a recording mechanism which will be hereinafter described in detail.

On the opposite end portion of tubing 19 is screw-threaded a cap-shaped closure member 29 having a valve seat at its center for receiving one end of a plunger 30 having a reduced portion 31 fitted for sliding movement in a drilled hole at the center of a cup-shaped member 32 held in adjusted position in the cylinder 19 by the clamping action of the cap-shaped member 29, while a spring 33 normally holds the valve thus formed in the closed position.

The cup-shaped member 32, the tubing 19 and the cap-shaped member 29 are provided with registering openings forming in cooperation with a series of openings 34 in the cup-shaped member 32 an air path connecting the atmosphere to the inside of tubing 19 for permitting in cooperation with valve 30 the free downward movement of rod 20. The air path formed by the drilled holes in member 32, the tubing 19 and the cap 29 is adjustable by the turning movement of the cap-shaped member 29 for controlling the exhaust of the air from the cylinder 19 under the action of piston 25 for controlling the movement of rod 20 to normal under the tension of spring 27.

To the flange portions 17 and 18 of mounting plate 16 is secured as by a plurality of screws 35 and 36 a guiding member 37 fitted with a slider member 38 to which is secured a bushing 39 shown in Fig. 5 having a drilled hole in which is fitted for free longitudinal movement therein a stylus 140, the slider 38 being operatively connected to weight 28 by a rod 40 having one end pivoted on bushing 39 and its opposite end to a stud 41 serving as a set screw for securing the weight 28 to rod 20. A spring 42 carried by connecting rod 40 serves to press the stylus 140 against a card 43 for recording the movement of the rod 20 as will be hereinafter described in detail.

The holder 44 for the card 43 as best seen in Figs. 2, 4 and 5 is mounted for sliding movement on two parallelly disposed rods 45 and 46. The rod 45 is supported at both ends by downwardly extending lug members 47 formed with the flange 18 of plate 16 and held securely against longitudinal movement thereon by a screw 50, while the rod 46 is supported at both ends by lugs 48 and 49 formed with flange portion 17 of plate 16 and secured against longitudinal movement by a screw 51. The movement of card holder 44 transverse to the movement of stylus 140 is effected by the rotation of a lead screw 52 Figs. 2, 3 and 6 engaged by a stud or plunger 53 mounted for sliding movement in a sleeve 54 itself screw-threaded in a bushing 55 carried by the card holder 44. A spring 56, the tension of which is controlled by the adjustment of sleeve 54, serves to hold the plunger 53 in engaged relation with the lead screw 52, the disengagement of such a plunger from the lead screw 52 being effected by unscrewing the sleeve 54 from bushing 55 a distance sufficient to permit the engagement of the

sleeve 54 with a nut 57 at the reduced end of plunger 53.

The rotation of lead screw 52 is effected by an arm 58 having a longitudinally disposed slot engaged by a stud 59 laterally extending from the weight 28. Arm 58 is mounted for pivotal movement as a unit with the gear sector 69 on a shoulder screw 60 engaging a downwardly extending lug 61 formed with the flange portion 17 of plate 16 as best seen in Figs. 2 and 3. The gear sector 69 meshes with a pinion 62 mounted for free rotation on lead screw 52, the pinion 62 and the lead screw each being formed with a similarly sized cylindrical portion 63 and 64 Fig. 2 cooperating with a coiled spring 65 fitted thereon to form a clutch mechanism for imparting a unidirectional movement to the lead screw 52 in response to the two-way movement of pinion 62 as effected by gear sector 69 and arm 58, the latter being in operative engagement with the stud 59 carried by weight 28 as above described.

The lead screw 52 is supported at one end by lug 49 and is provided at this end with a friction disc 163 abutting against the inner disposed side of lug 49 under the action of a spring 164, the tension of which may be adjusted by a plug 165 in a sleeve 66 threadedly engaging a bushing 67 and supporting one end of lead screw 52, bushing 67 being secured as by welding to lug 48 formed with flange portion 17.

The holder 44 has two of its opposite parallel edges bent in a manner to form grooves for receiving the opposite edges of card 43, the latter being held securely thereon by a spring 70 secured to the card holder as by a plurality of rivets 71, a handle portion 72 being provided to assist in flexing the spring 70 for permitting the insertion or removal of the card as the case may be.

In a typical example of operation, supposing that a package containing the impact recording apparatus of this invention and articles being shipped to a given destination is propped, as in handling, from any height within the sensitivity of the recorder mechanism, the impact received by the casing is imparted to weight 28 causing the longitudinal movement of rod 20 against the tension of spring 27 and thereby the movement of stylus 40 a corresponding distance on the card 43 through the operation of slider member 38 and the connecting rod 40. The movement of rod 20 and the weight 28 carried thereby is effective to impart an angular movement to arm 58 for rotating the gear sector 69 and thereby the pinion 62 and its clutch cylindrical portion 63 ineffectively relative to lead screw 52 which is held from rotation during the movement of pinion 62 by disc portion 163 bearing against the inner disposed side of lug 49 under the tension of spring 164 with the result that the card holder 44 is not operated during the movement of the stylus on the card for recording the impact. The downward movement of rod 20 and the piston carried thereby in the cylinder 19 is effective to generate a vacuum to cause the opening valve 30 for permitting the free movement of the rod 20 during the movement of the stylus for recording the impact. On the return movement of rod 20 by the tension of spring 27 however the valve 30 is closed by the tension of spring 33 so as to cause the air from the cylinder to flow through the air path formed by the opening in cap 29 and the opening in cylinder 19, this opening being adjustable for controlling the return movement of the rod 20 to any speed desired so as to prevent

the bouncing or recoil of rod 20 under the action of spring 27.

The return movement of rod 20 to normal is effective to rotate the pinion 62 in a clockwise direction to cause the clutch spring 65 to wind tight on the drums 63 and 64 for rotating the lead screw 52 and thereby moving the holder 44 and the card 43 secured thereon for recording another impact as above described, such recording operation being continued from the shipping point to the point of destination as indicated by the card shown in Fig. 7, which is a facsimile of a card on which the impacts received by a package in transit from New York to Chicago have recorded, these impacts ranging from a few inches drop to a maximum of four feet.

The removal of the card from its holder is readily effected by the turning of sleeve 54 to cause the disengagement of plunger 53 from the lead screw 52 and manually returning the holder to its start recording position shown in Fig. 3. In that position the spring 70 is flexed by the movement of handle 72 for releasing the recorded card and the insertion in the holder of a new card which is followed by the turning movement of sleeve 54 for reengaging the plunger 53 with the lead screw.

What is claimed is:

1. An impact recording apparatus comprising a mounting element, an impact responsive mechanism mounted on said element, a pair of parallelly disposed rods supported by means carried by said element, a holder for a card mounted for sliding movement on said rods, a lead screw, means carried by said holder for engaging said lead screw to cause the operation of said holder upon the operation of said impact responsive mechanism, a stylus, a slider member for supporting said stylus, guiding means for said slider member carried by said mounting element, means operatively connecting said slider member to said impact responsive mechanism, and means carried by said connecting means for pressing said stylus against said card for recording the operation of said mechanism upon an impact received by the apparatus.

2. In an impact recording apparatus a longitudinally movable element responsive to an impact received by the apparatus, a holder for a card, a stylus, a mechanism operatively connecting said movable element to said stylus for recording the movement of said element on said card, another mechanism actuated by said element including a lead screw for imparting movement to said holder following each operation of said stylus, a spring-pressed plunger carried by said holder for engaging said lead screw to cause the movement of said holder, and manually operable means carried by said holder for disengaging said plunger from said lead screw for returning said carriage to start recording position following the completion of the recording operation on said card.

3. An impact recording apparatus comprising an impact responsive mechanism, a stylus operated by said mechanism, a lead screw, a holder for a card mounted for movement at right angles to the movement of said stylus upon rotation of said lead screw, a combined lever and gearing mechanism actuated by said impact responsive mechanism, a one-way effective clutch actuated

by said gearing mechanism for rotating said lead screw; a mechanism operatively connecting said holder to said lead screw, said mechanism comprising a bushing carried by said holder, a sleeve threadedly engaging said bushing, a plunger fitted for sliding movement in said sleeve, a spring tensioned by the movement of said sleeve for pressing said plunger in engaged relation with said lead screw, and means carried by said plunger engageable with said sleeve for withdrawing said plunger from engagement with said lead screw upon unscrewing said sleeve for permitting the manual return movement of said card holder to normal starting position following the completion of recording operations on said card.

4. An impact recording apparatus comprising an impact responsive mechanism, a stylus operated by said mechanism, a lead screw, a holder for a card mounted for movement at right angles to the movement of said stylus, a gearing mechanism actuated by said impact responsive mechanism, a one-way effective clutch mechanism for imparting a unidirectional movement to said lead screw actuated by said gear mechanism, and a friction mechanism for preventing rotation of said lead screw during the non-effective operation of said clutch mechanism.

5. In an impact recording apparatus, a mounting element, a cylinder carried by said element, a rod, said element having means for slidably receiving one end of said rod, a weight carried by said rod, a piston mounted on said rod for movement in said cylinder, a spring disposed for tensioning by the movement of said rod as effected by an impact received by the apparatus, a recording mechanism comprising a stylus actuated by the movement of said rod, a pivoted lever member having an opening disposed lengthwise thereof, a stud carried by said weight extending in the opening of said lever for actuating the latter upon a longitudinal movement of said rod, a gear sector movable as a unit with said lever, a shaft supported by said mounting element having a lead screw portion, a pinion mounted for free rotation on said shaft, a clutch member formed with said pinion, a clutch member carried by said lead screw, a coiled spring fitted on each of said clutch members and cooperating therewith for imparting a unidirectional movement to said lead screw upon a two-way movement of said gear sector, a pair of guiding rods supported by said mounting plate in parallel relation to said lead screw, a holder for a card mounted for sliding movement on said rods and having means normally disposed in operative relation with said lead screw for moving said holder one step for each operation of said rod for recording the successive movement thereof on said card.

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