May 12, 1942.

A. E. F. BILLSTEIN

RAIL MARKING DEVICE

2,282,929

Filed Nov. 9, 1940

2 Sheets-Sheet 1

FIG. 1

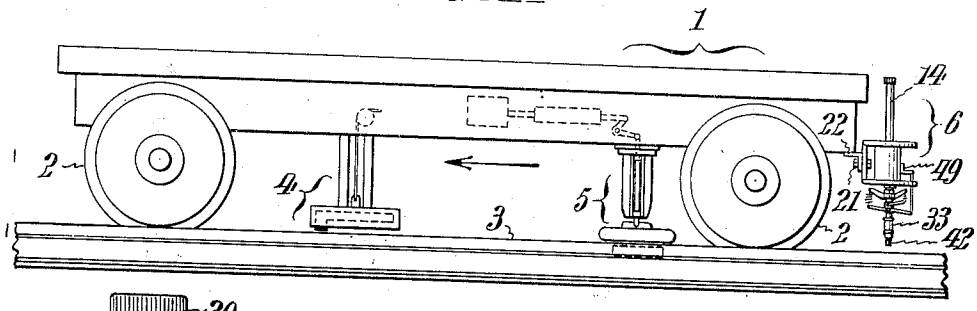

FIG. 2

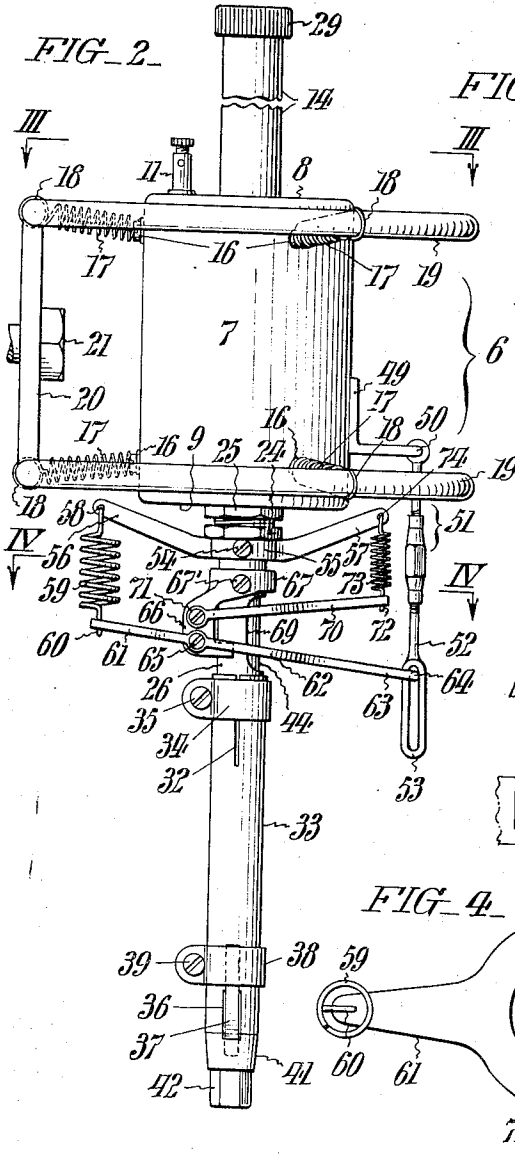

FIG. 3

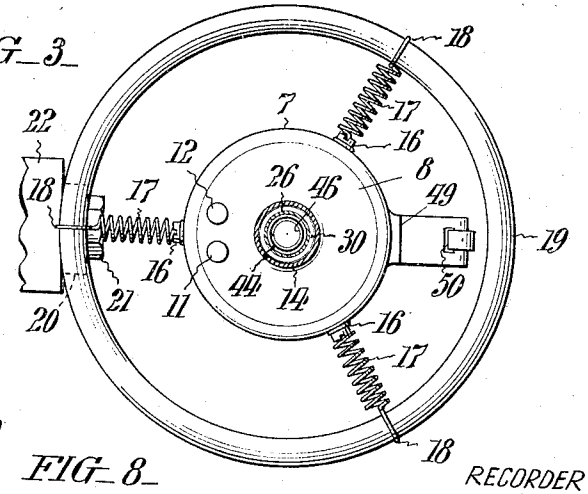

FIG. 8

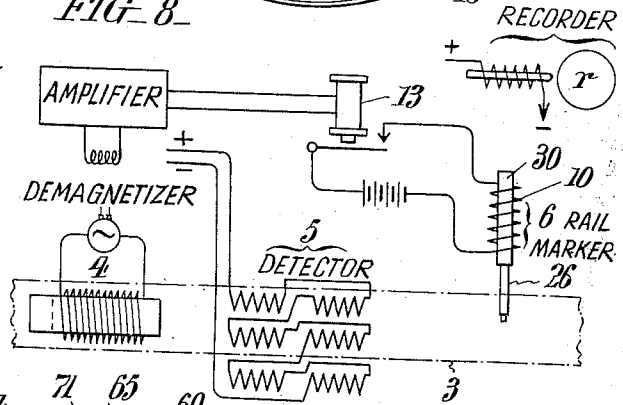

FIG. 4

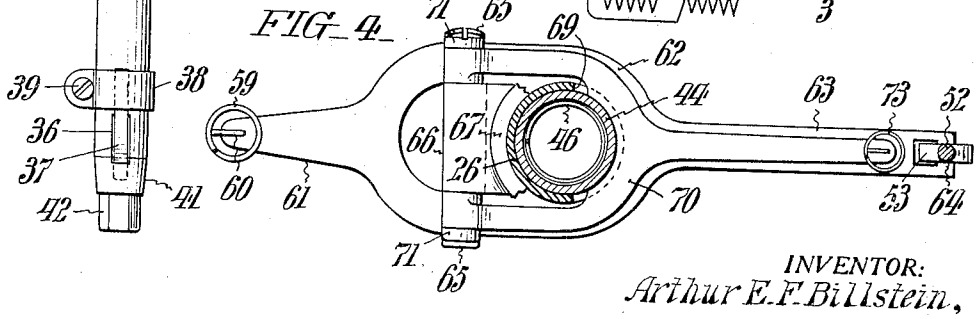

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FIG. 6

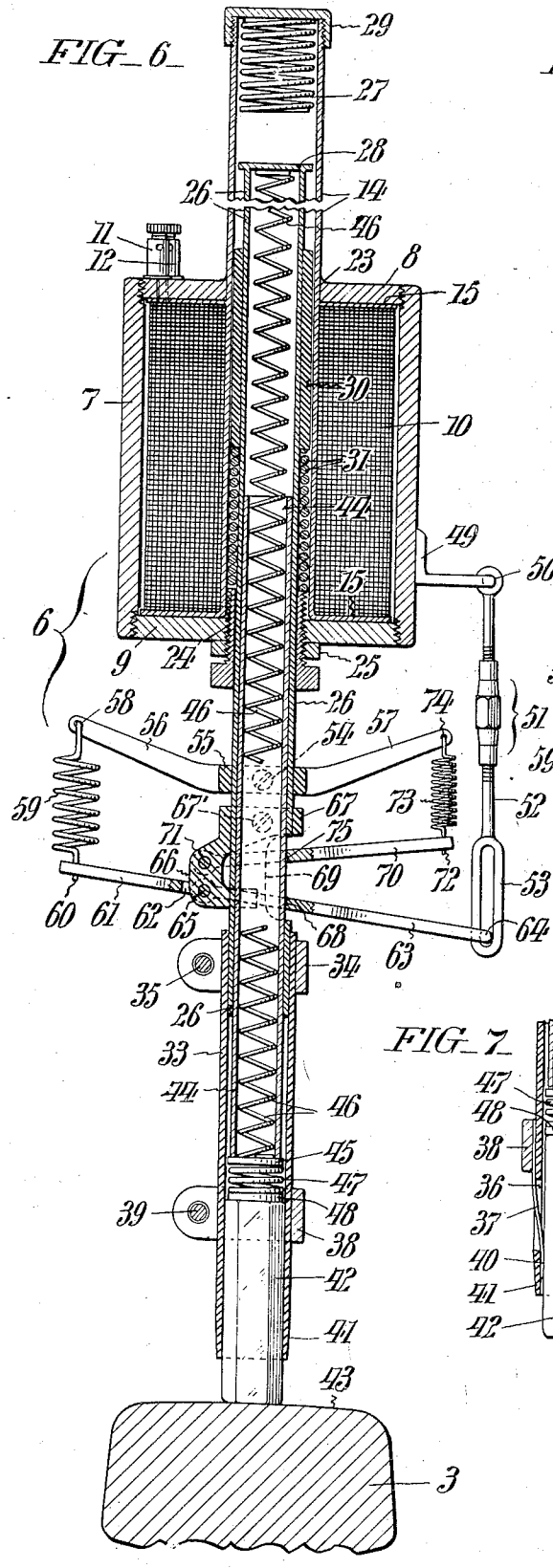

FIG. 5

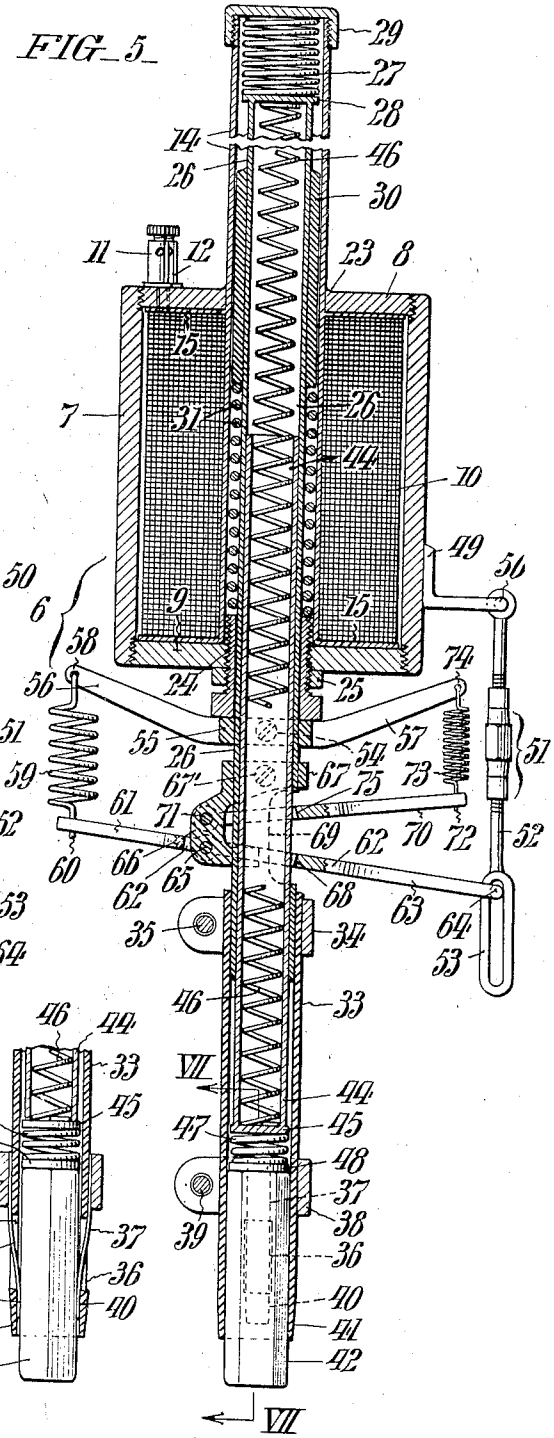

FIG. 7

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RAIL MARKING DEVICE

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Application November 9, 1940, Serial No. 364,956

13 Claims. (Cl. 234—70)

This invention in its broader aspects has reference to devices for making marks on solid or hollow materials for indicating local defects not ordinarily visible and incidentally discovered by testing, while it relates more particularly to the species automatically operative to deposit readily discernible media on track rails, bars and the like, subjected to test for the purpose of locating internal flaws, fissures and cracks, as well as external defects, by means effective to set-up a magnetic field around such articles.

Devices of the species referred to when included in a track rail inspection car are associated with a detector unit, an indicating means and a marking means operative to spray or deposit a relatively short mark of fluent medium, such as paint, in the vicinity of the defect, whether internal or external and incidental to location of the defect. Such marking means or devices are generally responsive to variations in electric current flow or voltage drop between spaced points along a rail or conductor energized by electric current.

The present invention has for its primary object the elimination of the disadvantages inherent in the use of a fluent medium such as the inability to localize the media to the small area necessary for successful rail testing. Also to locate the mark directly at the point of defect, by utilizing crayon or a non-fluent marking medium, rather than on the rail base giving the operator a better opportunity to promptly locate such defect.

Another important object is to provide an electromechanically actuated marking device of the indicated type adapted for direct physical contact with the rail undergoing test, as well as eliminating the possibility of false markings due to surface irregularities in such rail.

A further aim is to provide a resiliently mounted marking device preferably for rail testing cars which includes means for automatically feeding forward the crayon incidental to usage and for compensatively absorbing all operating shocks.

Other objects, with ancillary advantages, of this invention will become apparent from the following detailed explanation of the preferred embodiment thereof shown by the accompanying sheets of illustrative drawings, wherein like reference characters designate corresponding parts in all the views; while the concluding claims more particularly define the features of novelty over the prior art.

In the drawings:

Fig. 1 is a somewhat diagrammatic side elevation of a railroad track inspection car with rail testing equipment including the "marker" of this invention.

Fig. 2 is a broken elevation of the marking device detached from the car.

Fig. 3 is a plan section, taken approximately as indicated by the arrows III—III in Fig. 2.

Fig. 4 is a larger scale cross-section on the plane IV—IV of Fig. 2.

Fig. 5 is a broken longitudinal section through the marking device with the relatively movable parts in the normal or inactive position.

Fig. 6 is a similar sectional view with the various parts in the active position with respect to a fragmentary portion of a rail head.

Fig. 7 is a fragmentary sectional view within the confines of the arrows VII—VII of Fig. 5 or at right angles to the plane of the latter figure; and,

Fig. 8 is an electric diagram hereinafter more fully explained to illustrate the manner of actuating the marking device of this invention.

In describing the embodiment of this invention exemplified in the two sheets of illustrative drawings herewith, specific terms will be employed for the sake of clarity, but it is to be understood the scope of said invention is not thereby limited; each such term being intended to embrace all equivalents which perform the same function for an analogous purpose.

As hereinbefore mentioned and by way of exemplifying a practical application of this invention, its adaptation to a railway track-testing inspection-car **1**, Fig. 1, having conventional wheels **2** for traversing track rail **3** will be described; said car including a de-magnetizer **4** preferably of the type disclosed in my prior U. S. Patent No. 2,218,784, dated October 22, 1940, a flaw detector **5**, and the novel electro-mechanically actuated marking-device, comprehensively designated **6**.

This novel marking-device **6**, as best seen in Figs. 2, 5 and 6, comprises a cylindrical shell or casing **7** fitted with screw-in ends **8**, **9**, and it houses the exciting coil **10**, which receives current by way of suitable terminals **11**, **12** from any convenient source of supply, not shown, under control of a relay **13**, Fig. 8. Mounted concentrically and lengthwise within the casing **7** is the one end portion of a non-magnetic metal tube **14**—such as brass—including spaced flanges **15**, between which the exciting coil **10** is wound, said flanges also affording rigid abutment for the

screw-in ends 8, 9, whereby the casing 7 and tube 14 are rigidly attached together. The casing 7 is provided with circumferentially-spaced upper and lower connectors 16 for the inner ends of coil springs 17, the looped outer ends 18 of the latter being firmly engaged with preferably round-section annuli 19; and said annuli are rigidly maintained in parallelism by a spacer 20. This spacer 20 is bored or otherwise formed for passage of a clamp bolt 21 whereby the device 6 is adjustably attached to a supporting-bracket 22, Fig. 1, provided for the purpose on the car 1. Thus it will be readily seen and understood that the electromechanical marking-device 6 is resiliently supported relative to the car 1; while the tube 14 is preferably united to the screw-in end 8 by a surrounding fillet 23, Figs. 5 and 6, of appropriate character.

Screw-threaded through the end 9 is a polygonally flanged sleeve 24, fitted with a lock-nut 25 whereby provision is made for axial adjustment of said sleeve. The sleeve 24 affords slidable guidance for a second or intermediate brass tube 26 coaxial with the first mentioned tube 14, said tube 26 being cushioned by a buffer spring 27, intermediate its closed-in end 28, attached to a screw-cap 29 threadedly engaged on the outer end of the tube 14, when the marking device is in the inactive position best shown in Fig. 5. The tube 26, for purposes of differentiation will be hereinafter referred to as the "core-tube," inasmuch as it has permanently affixed thereto—in appropriate location intermediate the ends—an iron sleeve or core 30, with an associated influencing or return spring 31 between its inner extremity and the confronting end of the sleeve 24 above referred to.

Coupled to the outer end portion of the core-tube 26, is a longitudinally-split section 32 of a tubulate aluminum holder 33, means such as a split-collar 34 and clamp means 35, conveniently, although not essentially, serving as the coupler device. This holder 33 is provided with opposing longitudinal slots 36 for passage of inwardly-active flat springs 37 having their upper ends engaged in a second split-collar 38 with an associated clamp means 39, and the lower ends 40 are flexed inwards for grip coaction intermediate the bore of the holder tapering end 41 and the confronting faces of a polygonal section crayon 42, preferably of appropriate prepared chalk—or other suitable composition—and color for making a clearly discernible mark on the rail head top surface 43, Fig. 6.

Telescopically fitting the "core-tube" 26 is an inner brass tube 44 having projection concentrically of the crayon holder 33 with the outer end closed at 45 for abutment by the adjoining end of a coil spring 46, the upper end whereof abuts the inner face of the "core-tube" closed-in end 28; and, externally of the closed end 45 is a comparatively short buffer spring 47 in abutment with a pad 48 engaging the inner end of the crayon 42.

In order to control relative movement of the pipe assembly 26, 44, the means now to be described is employed, said means comprising an angle bracket 49 firmly attached to the casing 7 and affording pivotal connection at 50 for the upper component of a turnbuckle 51, the aligned component 52 whereof is provided with a longitudinally slotted section 53 for a purpose hereafter explained. Securely clamped to the "core-tube" 26, as by a set screw 54, is a movement limiting collar 55 embodying opposingly directed arms 56, 57, the former of which affords connection at 58 for one end of a recoil spring 59 in turn coupled at 60 to the spacedly-related arm 61 of a yoke lever 62, while the aligning arm 63 whereof has its free end 64 in loop-connection with the turnbuckle component slotted section 53. The yoke lever 62 is fulcrumed at 65 to the lower saddle portion 66 of a sleeve-like bearing 67 rigidly attached to the "core-tube" 26, by suitable means 67', below the collar 55 aforesaid. Thus it will be readily understood that the edge of the lever yoke portion 62, farthest removed from the fulcrum 65, under the influence of the recoil spring 59 arrests downward movement of the inner tube 44 by impinging the confronting face of said tube at 68, Fig. 5, the stationary "core-tube" 26 being cut-out or lengthwise slotted at 69 to accommodate such impingement. For opposing upward coaction with the telescopic inner tube 44, when in the downward or outwardly projected position for contact of the crayon 42 with the rail 3, as shown in Fig. 6, use is made of a forked brake-lever 70 having the bifurcate portion fulcrumed at 71 to the bearing saddle 66, above referred to, with the leg section end coupled at 72 to one end of a recoil spring 73, in turn similarly connected at 74 to the outer end of the movement limiting collar arm 57. Now, it will be readily appreciated from an inspection of Figs. 5 and 6 that the crotch 75 of the brake lever 70, under recoil action of the associated spring 73, is designed to impinge and arrest the tube 44 when the marking device 6 is projected into the active position of Fig. 6, just prior to contact of the crayon 42 with the head of the rail 3 as cushioned by the buffer spring 47.

Having described the structural aspects of this invention, and by joint reference to the diagram of Fig. 8, it is to be particularly noted that the marking device 6 is preferably included in the electrical hook-up for the flaw detector 5; whereas the de-magnetizer 4 and recorder *r* are entirely separate therefrom or are individually served from other sources of electric energy, not shown. Now it will be clearly apparent that when the relay 13 closes the circuit by way of the terminals 11, 12 electrical energy passes through the exciting coil 10, whereupon the core 30 and attached tube 26 will be drawn-in or pulled down in opposition to the normal influence of the return spring 31, and at a stroke of constant length determined by the action of the levers 63, 70, until the crayon 42 is worn down by repeated impacts with the rail running surface 43; whereupon the yoke lever end 64 by engaging the bottom of the turnbuckle slot 53 is slightly lifted, and thereby automatically releases the telescopic inner tube 44 for further outward movement, under the action of the spring 46, to push the crayon 42 correspondingly forward relative to its holder 33, or into normal rail marking position. The buffer spring 47 below the closed-in end 45 of said inner tube 44 functions to effectively cushion the impact with resultant elimination of any "mashing" of the crayon outer end; while the buffer spring 27 cushions the up-stroke of the inner tube 44 in opposition to the action of the spring 46 or prevents impact of the parts 28, 29. Clearly the sensitivity of the crayon impact with the rail head surface 43 is controlled by the point of arrestation afforded the yoke lever 62, compensatively to the compressive capacity of the spring 47. In other words, by the means just explained a constant cushioned marking contact of the crayon 42 against the rail surface 43 is

positively maintained with an automatic forward feed of said crayon at intervals determined by the slotted section **53** of the turnbuckle **51** until the crayon **42** is worn down. The up-stroke or movement of the pipe assembly **26**, **44** with the associated parts, to the inactive position of the marking device **6**, is effected by the expansion of the return spring **31**. This movement is effected by initial impingement of the fork lever crotch edge **75** with the inner tube **44**, under the recoil action of its controlling spring **73**, whereupon the pipe assembly **26**, **44** and associated parts advance upwardly in unison.

From the foregoing it will be readily appreciated that the crayon **42** exerts a definite pressure on the rail **3**, determined by the compressive limits accorded the spring **47**; also the extent of outward movement controlling advancement of said crayon for each marking operation is adjunctively controlled by expansion of the buffer spring **47** in opposition to the frictional grip of the flat springs **37**. Still further it is to be noted that the fork lever **70** coacts with the inner tube **44** at all times with a positive braking movement-retarding upward action, in order to prevent the crayon **42** from being pushed up into the tube **33** out of contact with the rail surface **43**. Still further, when the exciting coil or solenoid **10** is de-energized, it is obvious the return spring **31** projects the core-tube **26** sharply upwards in opposition to the buffer spring **27**, while the retarding action imparted thereto by the fork-lever crotch **75** prevents said tube from passing beyond the pre-adjusted limit determined by the turn-buckle **51**. It is to be also remarked that the guide sleeve **24** is adjusted and locked by the nut **25** at an elevation relative to the movement limiting collar **55** so that when the pipe assembly **26**, **44** and associated parts are shot upwards by the return spring **31**, said collar does not violently impact the outer end of the sleeve **24** due to the reactive influence of the respective springs **46**, **47**, and **59**, **73**. Furthermore, it will be obvious that this invention is not restricted to the marking of stationary rails by progression relative thereto, but that the reverse may equally well be employed or the rail moved proximately along with respect to marking device **6** when stationarily mounted.

Finally, while one practical embodiment of this invention has been fully explained in connection with the accompanying drawings, it is to be understood that said invention is not limited thereby but is capable of a variety of other mechanical expressions, and that changes may be made in the form, details of construction and arrangement of parts without departing from the spirit of said invention. Reference is accordingly to be had to the following claims for a definition of the limits and scope of this invention.

Having thus described my invention, I claim:

1. In means of the class described a marking device comprising an exciter coil, a core assembly of relatively telescopic components axially through the coil, a holder for a crayon at the outer end of one of the core components, means defining a constant active stroke for the core assembly, means operative to release the other core component just prior to completion of the core assembly active stroke for movement of the crayon into contact with the body to be marked, and recoil means for returning the core assembly to initial position when the exciter coil is de-energized.

2. In means of the class described a marking device comprising an exciter coil, a core assembly of relatively telescopic tubes axially through the coil, a holder for a crayon at the outer end of one tube, means defining a constant active stroke for the core assembly, means operative to release the other tube just prior to completion of the core assembly active stroke for movement of the crayon into marking contact with the body to be marked, means controlling excitation of the coil aforesaid for effecting the active stroke of the core, and recoil means for returning the core assembly to initial position when the exciter coil is de-energized.

3. In means of the class described a marking device comprising a resiliently-mounted coil, means controlling excitation of said coil, an outwardly-influenced core assembly concentric through the coil involving relatively-telescopic members, a crayon holder in continuation with one of said members, means controlling a constant active stroke for the core assembly, means operative to release one of said members just before completion of the core assembly active stroke to effect projection of the crayon into marking position, and recoil means for returning the core assembly to its initial position incidental to de-energization of the coil.

4. In means of the type described a marking device served with current from an individual source of supply comprising an enclosed coil with a tubular extension, means resiliently supporting the coil enclosure, means controlling excitation of the coil, an outwardly-influenced core assembly concentric with the coil and tubular extension, said assembly comprising relatively-telescopic tubes respectively having the outer ends closed-in, a crayon holder in continuation with the open end of one tube, opposingly influenced levers carried by the last mentioned tube and operative to control the active stroke of the core assembly, one of said levers serving to retard movement of the other tube just before completion of the core assembly active stroke to effect projection of the crayon into marking position, and recoil means for returning the core assembly to initial position incidental to de-energization of the coil.

5. In means of the type described a marking device comprising an enclosed coil with a tubular extension, means resiliently supporting the coil enclosure, means controlling excitation of the coil, an outwardly-influenced core assembly coaxial with the coil and tubular extension, said assembly consisting of outer and inner relatively-telescopic tubes respectively having the outer ends closed-in, means limiting outward movement of the core assembly, a crayon holder coextensive with the outer tube open end, opposingly operative levers pivotally carried by the outer tube and having tensile connection with the movement limiting means for effecting a constant active stroke of the core assembly, means engageable by one of said levers effective to release the inner tube at intervals as the crayon wears down for automatic feeding forward of said crayon into physical marking position, and recoil means for returning the core assembly to initial position concurrent with de-energization of the coil.

6. In means of the type described a marking device comprising an enclosure with an exciter coil and having a tubular extension at one end,

means supplying current for energizing the coil from an individual source, means resiliently supporting the coil enclosure, means controlling excitation of the coil, an outwardly-influenced core assembly coaxial with the coil and enclosure tubular extension, said assembly consisting of outer and inner relatively-telescopic tubes respectively having outer ends closed-in, means adjustably limiting outward movement of the core assembly, a crayon holder co-extensive with the outer tube open end, opposingly operative upper and lower levers pivotally carried by the outer tube and having tensile connection with the movement limiting means for effecting a constant active stroke of the core assembly, means engageable by one of said levers serving to release the inner tube at intervals as the crayon wears down for automatic ejection of said crayon into physical marking position, means adjustable to limit pivotal movement of the other lever, individual buffer means cushioning the movement limits of the core assembly, and recoil means for returning the core assembly to initial position concurrent with de-energization of the coil.

7. The combination of claim 6, wherein the coil enclosure is in the form of a cylinder having attached ends, a tube with spaced flanges is clamped coaxially of the cylinder between the ends with extension through and beyond one of said ends, a removable cap on the outer end of the tube extension, a guide sleeve adjustably engages through the other of said cylinder ends, means to lock the guide sleeve in position, and means securing the tube extension to the first mentioned cylinder end.

8. The combination of claim 6, wherein the core relatively-telescopic tubes include an inner continuous coil spring aligned between the closed-in ends thereof, a magnetic material sleeve is secured to the outer of said tubes, and an exterior coil spring intermediate said sleeve inner end and an abutment within the coil enclosure serves to return the core to its initial position.

9. The combination of claim 6, wherein the crayon holder is in the form of a tube having the inner end longitudinally split, means clamp said split tube to the open end of the core assembly outer tube, circumferential longitudinal slots are provided proximate the outer end of the split tube, and flat springs with an associated clamping collar have extension inwardly of the longitudinal slots for grip coaction with an inserted crayon.

10. The combination of claim 6, wherein the buffer means cushioning the movement limits of the core assembly consists of end abutting coil springs, one of which intervenes the outer tube closed-in end and the core tubular extension closure cap, and the other intervenes the core assembly inner tube closed-in end, and a pad on the inner end of the crayon.

11. The combination of claim 6, wherein the means supporting the opposingly-operative constant-stroke controlling levers is in the form of a sleeve bearing, said bearing having a saddle extension with through pins for pivotal connection of said levers, and coil springs engage opposite ends of the levers with anchorage to a stationary part of the marking device, whereby said levers are angularly influenced through the confronting portion of the outer tube into grip engagement with the inner tube of the core assembly.

12. The combination of claim 6, wherein the core assembly outer tube has a securely attached inward-movement limiting collar with opposedly directed arms, the lower opposingly-operative constant-stroke control lever is of yoke-formation with arms in spaced relation to the aforesaid collar arms, the upper lever is of fork-contour with the bifurcation crotch adapted to exert retarding action on the core-assembly inner tube, and coiled tension springs respectively couple one arm of the movement limiting collar to the registering arm of the yoke lever and the other arm of said collar to the leg end portion of the fork-lever.

13. The combination of claim 6, wherein the adjustable means for limiting pivotal movement of constant stroke controlling levers comprise a suitable bracket projecting from the marking device enclosure, and a turnbuckle device has one component connected to said bracket with the other component coupled by a slotted connection to the free end of the lower tension-influenced lever.

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