April 20, 1965 R. G. SCHILLING ETAL 3,179,948

PRINTING RECORDER

Filed Dec. 18, 1961

6 Sheets-Sheet 1

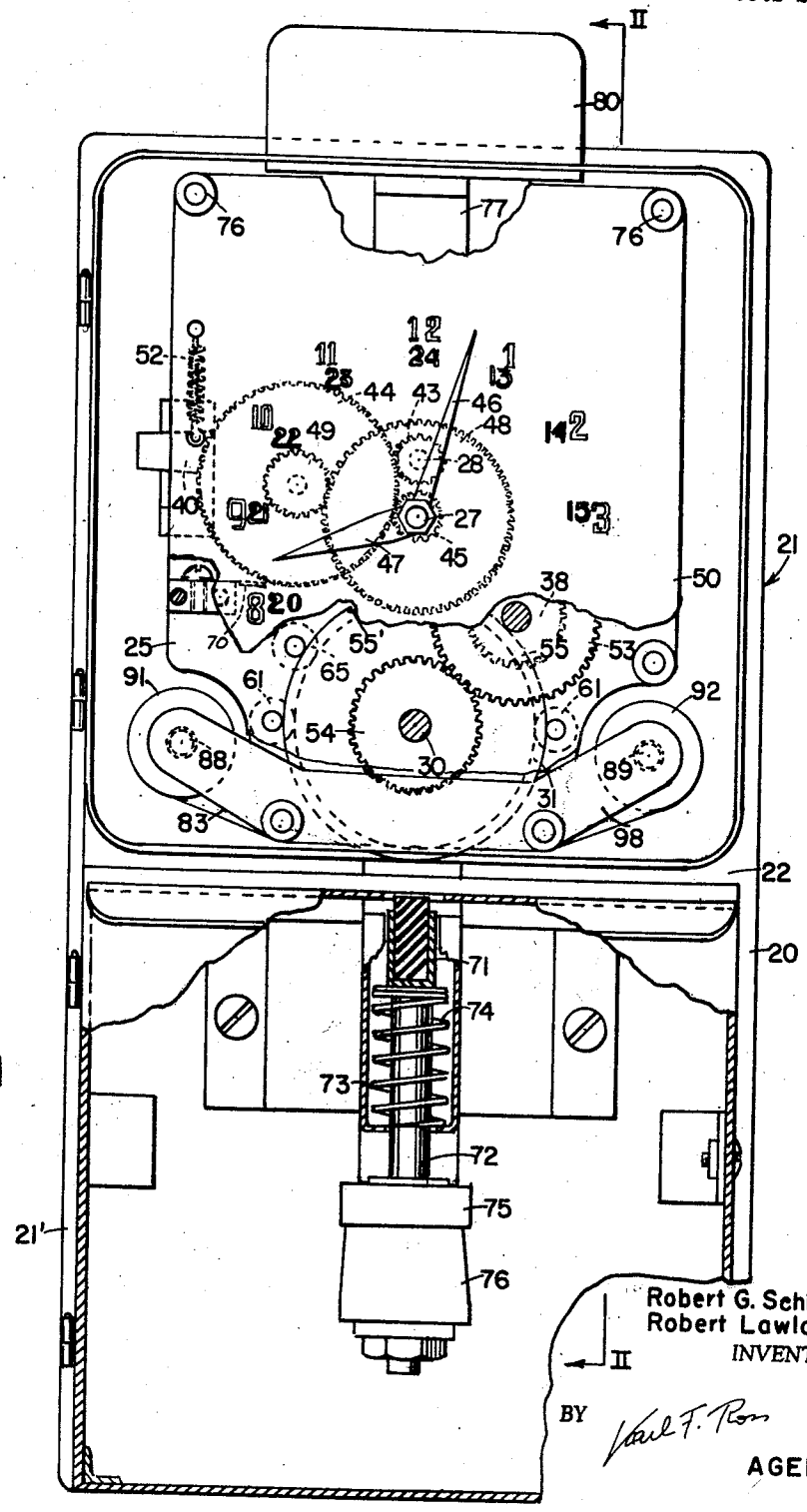


FIG. 1

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BY Karl F. Ross

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6 Sheets-Sheet 2

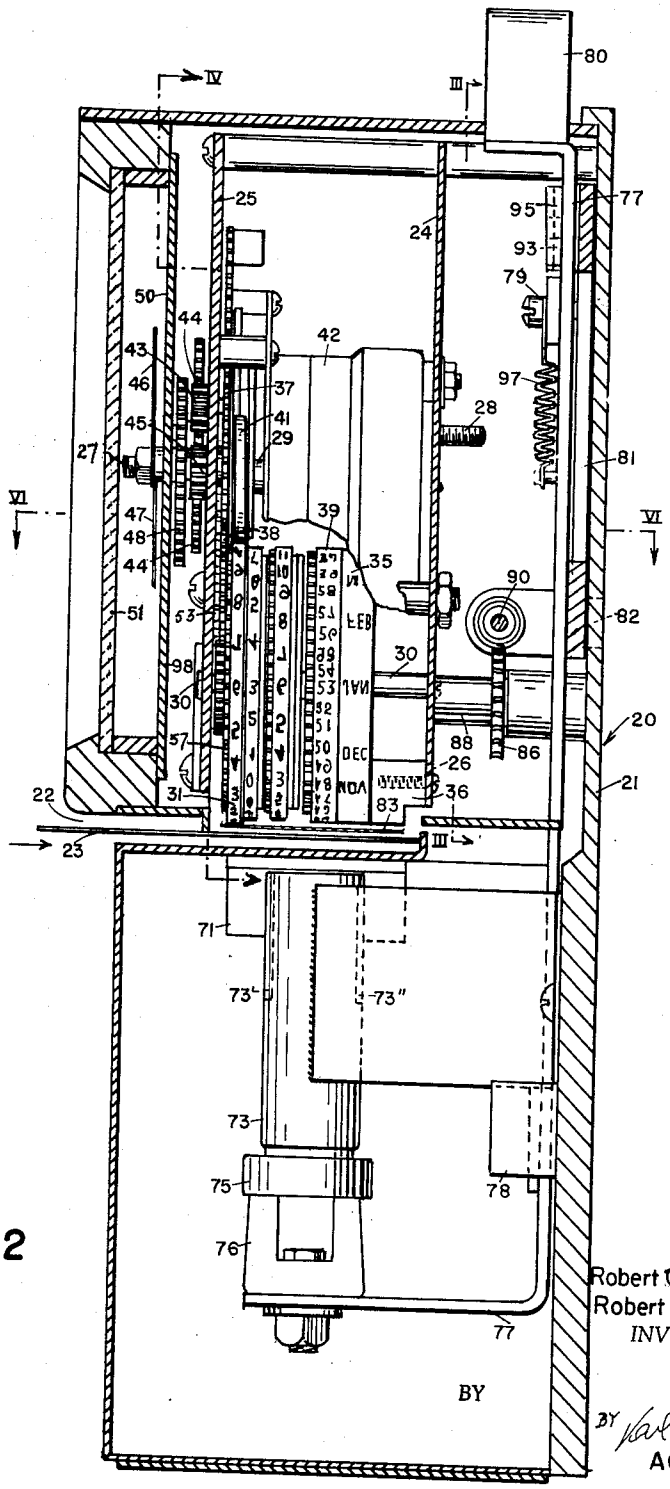


FIG.2

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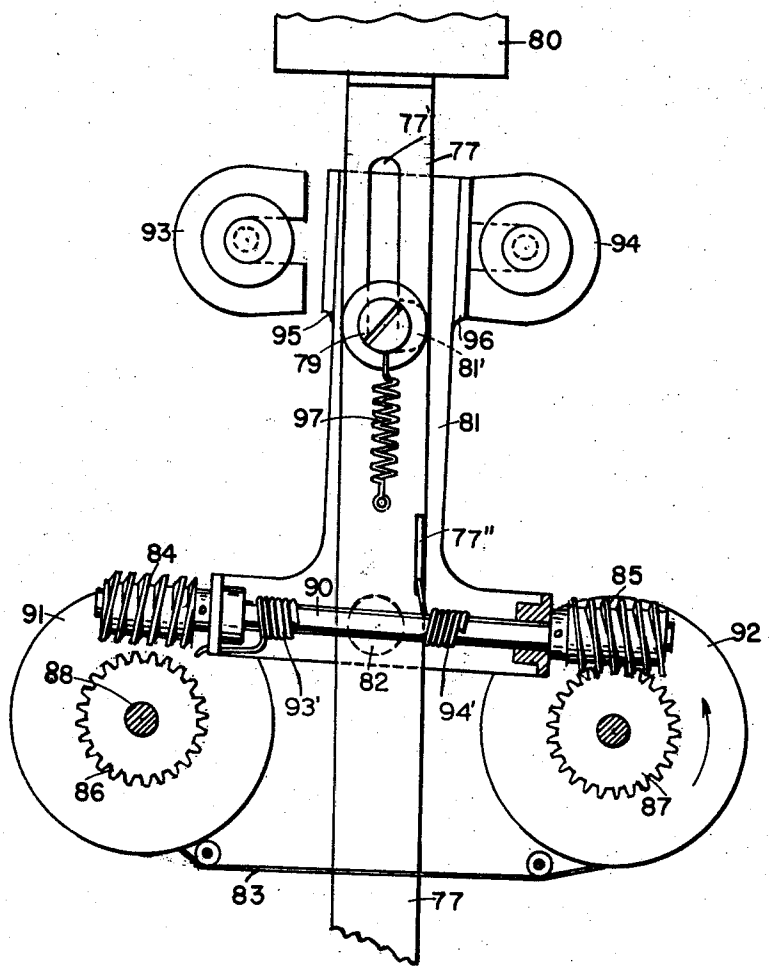


FIG.3

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April 20, 1965 R. G. SCHILLING ETAL 3,179,948

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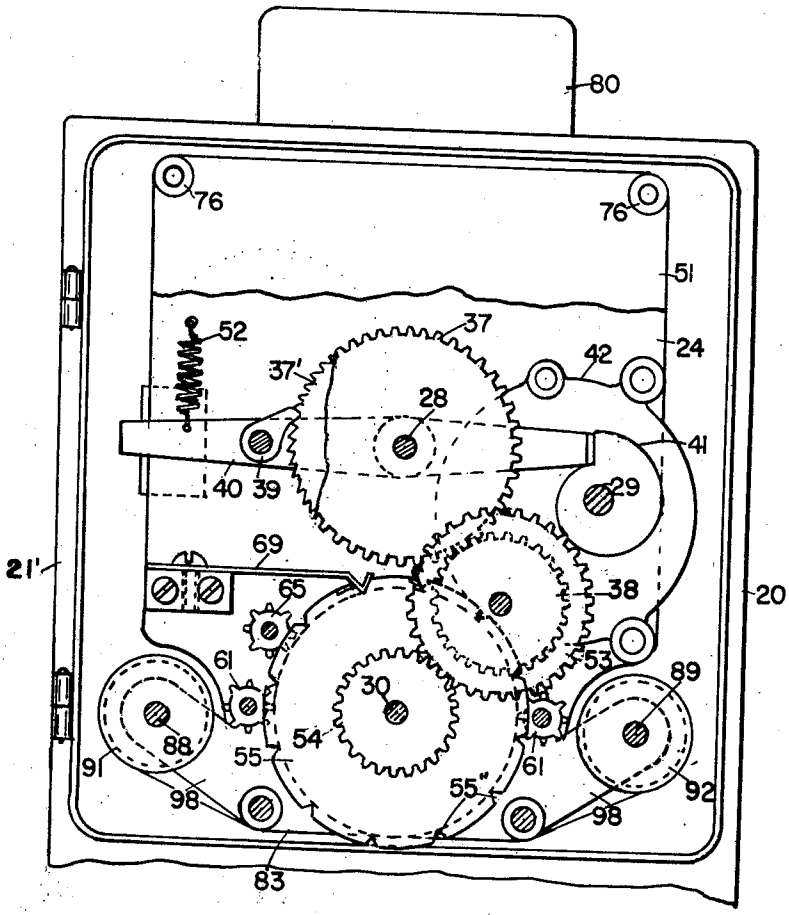


FIG. 4

Robert G. Schilling
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April 20, 1965 R. G. SCHILLING ETAL 3,179,948

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Filed Dec. 18, 1961 6 Sheets-Sheet 5

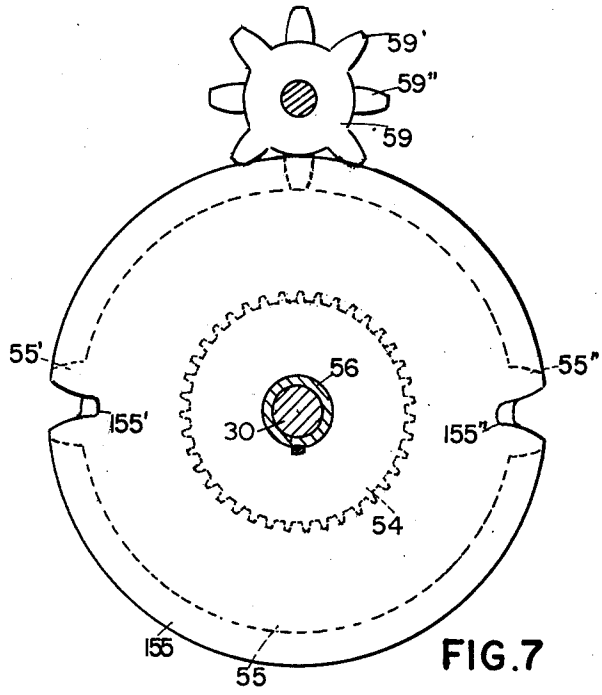


FIG.7

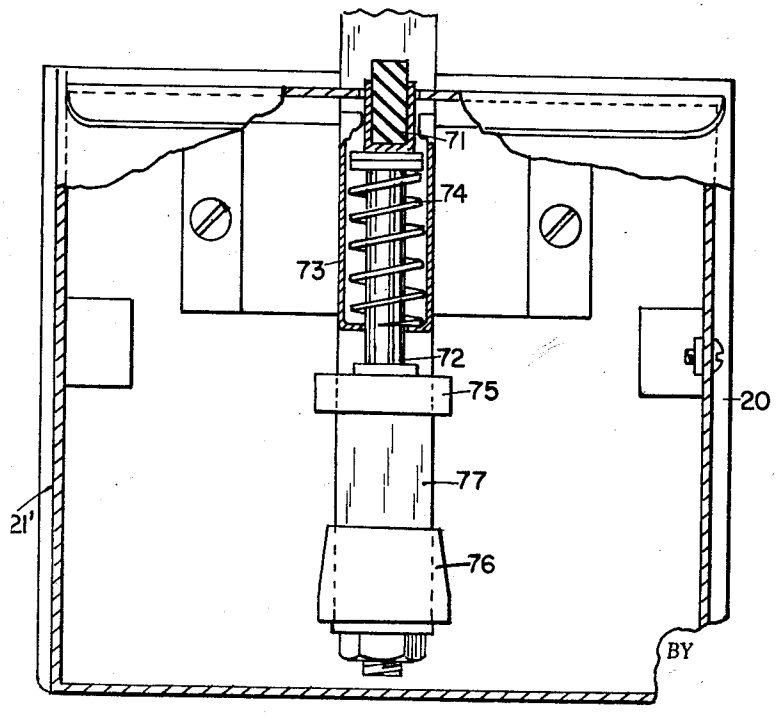


FIG.5

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April 20, 1965 R. G. SCHILLING ETAL 3,179,948

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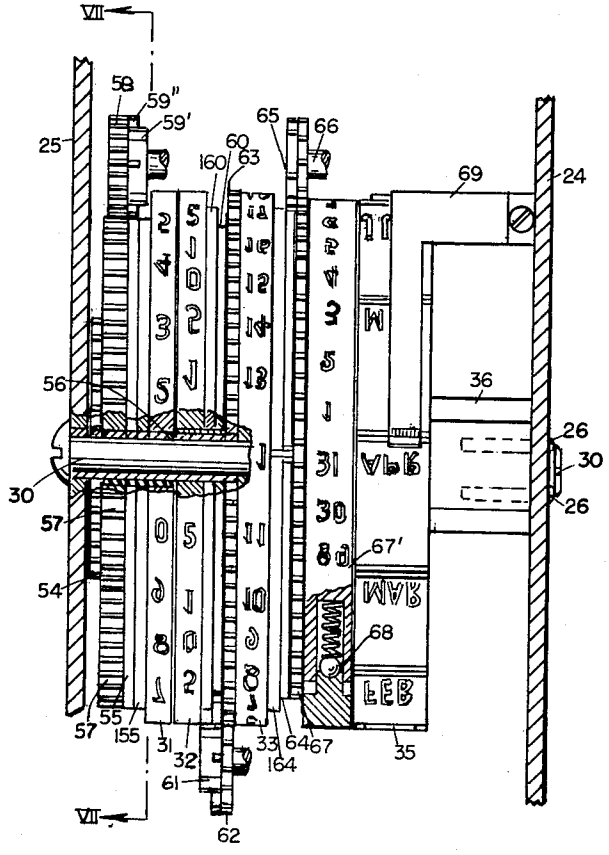


FIG. 6

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United States Patent Office 3,179,948
Patented Apr. 20, 1965

3,179,948

PRINTING RECORDER

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Filed Dec. 18, 1961, Ser. No. 160,098
6 Claims. (Cl. 346—95)

Our present invention relates to a printing recorder adapted to make a permanent entry of numerical or other data on punch cards and similar blanks. It is particularly concerned with devices suitable for producing a printed record of time or other information registerable by a single stroke of a ram or hammer working against an anvil with interposition of a recording medium.

An important object of the present invention is to provide a recording device for imprinting information on an inserted record card or blank by a mechanism which is of simple construction and sufficiently low in cost to enable its use at various operating stations in manufacturing or commercial establishments.

It is another object of this invention to provide a recording device which is positive and foolproof in operation, requiring merely the manual actuation of a handle to imprint recordable information on a blank, and which virtually excludes the possibility of inadvertent double recording.

It is a further object of our invention to provide, in a printing device using an elongated, progressively advancing marking medium such as an ink ribbon, an automatic ribbon-reversing mechanism which positively acts to change the direction of movement whenever substantially the entire ribbon has been wound upon one or the other of two spools.

In accordance with a feature of the instant invention we provide, in a recording device of the general character described, a preferably permanent magnetic member and an armature member therefor, in combination with means for forcibly separating the two members from each other while another force, e.g. that of a spring or a second magnet, entrains the liberated armature member in a direction way from the aforementioned magnetic member.

A system of this description has been found useful for both the printing mechanism proper and ribbon-reversing mechanism of such recording device. In the first instance we prefer to attach the armature member to a spring which, upon magnetic entrainment of that member against the spring force to an extent sufficient to separate it from its magnet, propels this member toward its anvil with a force which causes a printing hammer rigid therewith to pass beyond a normal position into printing contact with the recording blank to be marked, the armature thereupon returning to its normal position for subsequent re-engagement by the magnet as the latter is restored to its starting position. In the second instance we may provide a pair of fixed magnets acting upon a common armature which forms part of a toggle member and is pivotable therewith into engagement with either magnet, the toggle member carrying a pair of worms which coact with respective worm gears on two ribbon-coiling spools in alternately one or the other magnet-engaging position of the armature; when the spool of the engaged worm gear is arrested by the arrival of the ribbon in its limiting position, the associated worm, upon being driven by the printing mechanism at the next actuation thereof, is constrained to mount the teeth of its gear so as to be tilted out of its position and to flip the toggle member through is neutral position whereby the armature, disengaged from one magnet, will be attracted into contact with the other magnet and the opposite worm will engage its worm gear to drive the other spool.

The above and other features, objects and advantages of our invention will become more fully apparent from

the following detailed description of a preferred embodiment, reference being made to the accompanying drawing in which:

FIG. 1 is a front-elevational view of a time clock with a printer and a ribbon changer according to the invention (parts broken away);

FIG. 2 is a cross-sectional view taken on the line II—II of FIG. 1;

FIG. 3 is a cross-sectional view taken on the line III—III of FIG. 2, showing the ribbon-changing mechanism in detail;

FIG. 4 is a cross-sectional view of the upper half of the time clock, taken on the line IV—IV of FIG. 2;

FIG. 5 is a fragmentary sectional view similar to the lower half of FIG. 1, showing the printing mechanism in detail and in an alternate position;

FIG. 6 is a sectional view taken on the line VI—VI of FIG. 2; and

FIG. 7 is a sectional view taken on the line VII—VII of FIG. 6.

The time clock 20 shown in the drawing comprises a housing 21 provided with an insertion slot 22 for the introduction of a card 23 serving as a recording medium; housing 21 has a side door 21' to give access to its interior. The slot 22 is overlain by a set of typewheels 31, 32, 33, 34, 35, carried on a shaft 30, which may, for example, carry minute, ten-minute, hour, day and month characters, respectively; a block 36, bearing year indications, is exchangeably fastened by screws 26 to a rear plate 24 which together with a front plate 25 forms a frame removably secured to housing 21 by bolts 26. The plates 24, 25 are spanned by the typewheel shaft 30 and also by a drive shaft 28, this latter shaft projecting beyond both plates to enable a reversal of the frame 24, 25 when it is desired to operate on cards designed to receive the date and hour indications in the opposite order. Shaft 28 carries a gear 37 which meshes with a gear 38 and also has ratchet teeth 37' engageable by a pawl 39 on a lever 40, the latter being pivotable about the same shaft; a cam 41 on shaft 29, driven continuously by an electric motor 42, periodically trips the lever 40 against the face of a spring 52 to steps the gears 37 and 38, such stepping being also possible manually by means of the laterally projecting other extremity of that lever.

Gear 37, via its shaft 28, drives a pinion 43 which meshes with a gear 44, the latter engaging a pinion 45 to advance the minute hand 46 of a clockwork whose hour hand 47 is concurrently driven via a step-down transmission including a gear 48 in mesh with a pinion 49 rigid with gear 44 (FIG. 1). The hands 46, 47 are disposed between an opaque plate 50 and a transparent panel 51 supported by housing 21, the plate 50 carrying the associated clock face; hand 46 sits on a shaft 27.

Gear 38 is rigid with a gear 53 which meshes with another gear 54 on shaft 30; the latter gear is directly connected with the minute wheel 31 and also with a disk 55 interposed therebetween, the entire assembly 54, 55, 31 being freely rotatable on a tubular shaft 56 which is traversed by the typewheel shaft 30. Tubular shaft 56 has keyed to it the ten-minute wheel 32 and a gear 57 in mesh with a pinion 58, this pinion being rigid with a Geneva-type wheel 59 stepped periodically by two diametrically opposite pairs of teeth 55', 55'' on disk 55. In similar manner a disk 60, coupled with ten-minute wheel 32, periodically steps a Geneva wheel 61 rigid with a pinion 62 which meshes with a gear 63 joined to hour wheel 33; and a further disk 64, driven by the latter wheel (whose markings may run from 1 a.m. through 12 a.m. and from 1 p.m. through 12 p.m., or simply from 1 through 24), advances once during each revolution of a Geneva wheel 65 rigid with a pinion 66 which meshes with a gear 67 to drive the day wheel 34. This day wheel,

as shown in FIG. 2, is annular and formed with thirty-one internal teeth 34' indexed by a spring-pressed ball check 68 in a hub 67' of gear 67. The month wheel 35, yieldably arrested in any of twelve angular positions by an indexing spring 69 on plate 24, can be set manually. A similar indexing spring 70, carried on plate 25, engages the teeth of gear 38 to arrest the minute wheel 31 in any of its twenty operative angular positions.

Each of the disks 55, 60, 64 is positioned alongside a respective companion disk 155, 160, 164 rigidly coupled therewith. As particularly illustrated in FIGS. 6 and 7 for the disks 55, 155 and the associated Geneva wheel 59, the latter wheel has eight peripherally equispaced teeth 59', 59'' of which the alternate teeth 59'' have been axially foreshortened so as to register only with the disk 55, the remaining teeth 59' registering with both disks 55 and 155. Disk 155 is formed with a pair of radial slots 155', 155'' respectively aligned with the space between teeth 55' and 55''. Thus, upon movement of, say, the pair of driving teeth 55' past Geneva wheel 59 two teeth 59', 59'' will be successively entrained by these driving teeth so that the wheel 59 is rotated through 90°, the unforeshortened tooth 59' being cleared by the slot 155' of disk 155 while being straddled by the teeth 55'. As the disks 55, 155 continue to rotate, two adjacent teeth 59' will hug the periphery of disk 155, as seen in FIG. 7, to prevent any further motion of wheel 59 during the subsequent half-turn of disks 55, 155 and typewheel 31. The coaction between the remaining Geneva wheels and their associated disks is analogous.

The typewheel assembly 31–35 together with block 36 constitutes, in effect, the anvil of an imprinting mechanism whose hammer 71 (preferably of rubber) is carried on the upper end of a plunger 72 vertically slidable in a cylinder 73. A compression spring 74, resting on the bottom of that cylinder, normally maintains the hammer 71 in the position illustrated in FIGS. 1 and 2 in which its upper surface is just below the level of the insertion slot 22. The lower end of plunger 72 is secured to an armature member 75, of suitable magnetically permeable material such as soft iron, which normally overlies the legs of a bifurcate member 76 constituting the poles of a permanent magnet. It may be mentioned at this point that the operation described hereinafter would be identical if the member 75 were magnetic and the member 76 were merely magnetically permeable, or if both members were complementarily and permanently magnetized. Member 76 is mounted on the lower end of a bail 77 which is slidably guided for vertical motion along the inner rear wall of housing 21, this wall being for this purpose provided with guide lugs 78 while the bail 77 has a slot 77' traversed by a guide screw 79. A knob 80 at the top of bail 77 projects from the housing 21 for manual depression by the user. The cylinder 73 is formed with two diametrically opposite vertical chanels 73', 73'' which accommodate the extremities of hammer 71 and enable the downward entrainment of the punch, through the action of the magnetic coupling 75, 76, over a distance somewhat less than the range of displacement of bail 77 when the latter is depressed by its knob 80. A restoring spring 97 for bail 77 tends to maintain the latter in its elevated position.

A slight clearance between bail 77 and housing 21 is occupied by a T-bar 81 which is pivotable about a pin 82 and forms part of a toggle mechanism for the periodic reversal of a ribbon 83 passing just below the type faces of elements 31–36 near the top of the insertion slot 22. The shank of T-bar 81 has a slot 81' clearing the screw 79 whereby the latter acts as a stop limiting the swinging of the bar about its pivot 82 in either direction. The arms of the T-bar 81 support a pair of worms 84, 85 which are interconnected by a common shaft 90 and mesh with respective worm gears 86, 87, the shafts 88, 89 of these worm gears carrying two spools 91, 92 adapted to pay out and to receive the ribbon 83. Plate 25 has screwed to it an arm 98 whose laterally projecting extremities resiliently engage the shafts 88, 89 to enable the convenient removal and exchange of the ribbon-carrying spools 91, 92.

Two magnets 93, 94 are disposed on housing 21 at opposite sides of the upper extremity of the shank of T-bar 81 which carries armatures 95, 96 designed to cooperate with them. Again, as in the case of the coupling 75, 76, the magnetization of the ferromagnetic members 93, 94 and 95, 96 may be reversed or all of these members may be actively magnetic. As will be apparent from FIG. 3, only one of the worms 84, 85 (here the worm 85) is at any time in engagement with its worm gear 86, 87, the corresponding armature 95, 96 (here the latter) bearing at the same time upon its magnet 93, 94. Shaft 90 carries a pair of slipping coil springs 93', 94' of which the first one acts as a retaining pawl while the second one functions as a stepping pawl, these springs being so designed as to grip the shaft upon being displaced relatively thereto in a coil-tightening sense while enabling unhindered relative motion in the opposite sense. Thus, coil 93' has an extremity anchored to an arm of T-bar 81 whereas coil 94' has a corresponding extremity received in a vertical slot 77'' of bail 77 whose length is somewhat less than the range of displacement of that bail. As a result of this arrangement, any vertical reciprocation of bail 77 imparts a limited angular movement to the shaft 90 and, therefore, to the worms 84, 85; such movement occurs during the ascent of the bail as the lower end of slot 77'' entrains the engaged extremity of coil 93' for counterclockwise rotation (as viewed in FIG. 2) after this extremity had been entrained clockwise by the upper slot end during the preceding descent of the bail.

The operation of the recorder 20 shown in the drawing is as follows:

With the typewheel assembly preset manually and/or by motor 42 to register the information to be inscribed on a card 23, this card is inserted into slot 22 so as to lie between the hammer 71 and the ribbon 83. Next, the user depresses the knob 80 so that bail 77 is lowered, against the force of spring 97, as illustrated in FIG. 4. The magnet 76, in following the downward motion of bail 77, entrains the plunger 72 against the force of spring 74 until the movement of the plunger is arrested as the hammer 71 constituting the head of the plunger comes to rest on the bottom of slots 73', 73'' of cylinder 73. At this instant contact between magnet 76 and armature 75 is broken as the magnet continues its downward stroke; the armature 75 is now free from the magnetic pull so that the compressed spring 74 can expand and propel the hammer 71 against the card 23 whereby the latter is forced against the type faces of elements 31–36 through the intermediary of ribbon 83. Spring 74, tending to regain its expanded state, executes oscillations of progressively decreasing amplitude, thereby returning the hammer 71 to its initial position which it had overshot upon its release from magnet 76; these oscillations are sufficiently damped to prevent a second impression contact between the hammer and the card as the head of plunger 72 drops back onto the spring 74. When the knob 80 is subsequently released, bail 77 returns to its initial position and the magnet 76 re-engages its armature 75 to re-establish the conditions shown in FIG. 1.

The ribbon 83 is advanced after each printing operation as the return of the bail 77 rotates the shaft 90 and causes one of its worms to drive the spool shaft of its engaged worm gear, e.g. the gear 87. Thus, the ribbon moves one step to the right, as viewed in FIGS. 1 and 3, as long as the armature 96 rests against its magnet 94. When the ribbon has reached the end of its travel in this direction, its left-hand end anchored to spool 91 becomes taut so that spool 92, shaft 89 and gear 87 can no longer rotate. The next rotation of worm 85, accordingly, forces the helicoidal ridge of the latter out of engagement with the teeth of gear 87 so that the worm mounts these gear teeth and is cammed out of its illus-

trated position of engagement, this action imparting a counterclockwise pivotal movement to the assembly 81, 84, 85, 95, 96 so that armature 96 breaks contact with magnet 94 as the T-bar 81 swings through its neutral position between the two magnets. The hitherto inoperative manget 93 now attracts its armature 95 to complete the swing of the T-bar into its alternate limiting position in which worm 84 mates with its gear 86. Owing to the relatively reversed pitch of the worms 84 and 85, gear 86 is rotated upon the next stepping of shaft 90 in a sense causing the ink ribbon 83 to be wound upon spool 91.

It will be apparent that another reversal of the direction of ribbon motion will occur when the ribbon grows taut against spool 92 at the end of its leftward movement, the worm 84 then mounting its gear 86 to swing the T-bar 81 back to the position illustrated.

Our invention is, of course, not limited to the specific arrangement shown and described. Thus it will be understood, for example, that type faces such as those carried by elements 31–36 need not be positioned on the anvil portion of the system but may, in some instances, also be provided on the movable hammer. Also, electromagnets rather than permanent ones may be used if desired. These and other modifications, which will be evident to persons skilled in the art, are intended to be embraced within the spirit and scope of our invention as defined in the appended claims.

We claim:

1. A recording device comprising a hammer element and an anvil element, one of said elements having a typeface on a portion facing the other of said elements, said hammer element being normally separated from said anvil element by a clearance enabling the insertion of a recording medium, a first magnetically permeable member rigid with said hammer element, a second magnetically permeable member movably disposed adjacent said first member in a normal position of said members, at least one of said members being magnetized whereby said members are attracted toward each other, resilient means bearing upon said first member and tending to maintain both said members in said normal position, and actuating means coupled with said second member for displacing the latter from said normal position in a direction tending to remove said hammer element from said anvil element against the force of said resilient means, said first member being mounted for limited entrainment in said direction whereby continuing displacement of said second member by said actuating means separates said members from each other and enables said resilient means to propel said first member beyond said normal position into a position of marking contact between said recording medium and said elements.

2. A recording device comprising a hammer and a typeface carrier facing said hammer, said hammer being normally separated from said carrier by a clearance enabling the insertion of a recording medium, a first magnetically permeable member rigid with said hammer, a second magnetically permeable member movably disposed adjacent said first member in a normal position of said members, at least one of said members being magnetized whereby said members are attracted toward each other, resilient means bearing upon said first member and tending to maintain both said members in said normal position, and actuating means coupled with said second member for displacing the latter from said normal position in a direction tending to remove said hammer from said carrier against the force of said resilient means, said first member being mounted for limited entrainment in said direction whereby continuing displacement of said second member by said actuating means separates said members from each other and enables said resilient means to propel said first member beyond said normal position into a position of a marking contact between said hammer, said recording medium and said carrier.

3. A recording device comprising a hammer element and an anvil element, one of said elements having a typeface on a portion facing the other of said elements, said hammer element being normally separated from said anvil element by a clearance enabling the insertion of a recording medium, a magnetically permeable armature member rigid with said hammer element, a magnet movably disposed adjacent said armature in a normal position of said armature and said magnet while attracting said armature, resilient means bearing upon said armature and tending to maintain both said armature and said magnet in said normal position, and actuating means coupled with said magnet for displacing the latter from said normal position in a direction tending to remove said hammer element from said anvil element against the force of said resilient means, said armature being mounted for limited entrainment in said direction whereby continuing displacement of said magnet by said actuating means separates said armature from said magnet and enables said resilient means to propel said armature beyond said normal position into a position of marking contact between said recording medium and said elements.

4. A recording device comprising a hammer and a typeface carrier facing said hammer, said hammer being normally separated from said carrier by a clearance enabling the insertion of a recording medium, a magnetically permeable armature member rigid with said hammer, a magnet movably disposed adjacent said armature in a normal position of said armature and said magnet while attracting said armature, resilient means bearing upon said armature and tending to maintain both said armature and said magnet in said normal position, and actuating means coupled with said magnet for displacing the latter from said normal position in a direction tending to remove said hammer from said carrier against the force of said resilient means, said armature being mounted for limited entrainment in said direction whereby continuing displacement of said magnet by said actuating means separates said armature from said magnet and enables said resilient means to propel said armature beyond said normal position into a position of marking contact between said hammer, said recording medium and said carrier.

5. A recording device comprising a hammer and a set of adjustable typeface carriers facing said hammer, said hammer being normally separated from said carriers by a clearance enabling the insertion of a recording medium, a first magnetically permeable member rigid with said hammer, a second magnetically permeable member movably disposed adjacent said first member in a normal position of said members, at least one of said members being magnetized whereby said members are attracted toward each other, resilient means bearing upon said first member and tending to maintain both said members in said normal position, and actuating means coupled with said second member for displacing the latter from said normal position in a direction tending to remove said hammer from said carrier against the force of said resilient means, said first member being mounted for limited entrainment in said direction whereby continuing displacement of said second member by said actuating means separates said members from each other and enables said resilient means to propel said first member beyond said normal position into a position of marking contact between said hammer, said recording medium and said carrier.

6. A recording device comprising a hammer and a set of adjustable typeface carriers facing said hammer, said hammer being normally separated from said carriers by a clearance enabling the insertion of a recording medium, a magnetically permeable armature member rigid with said hammer, a magnet movably disposed adjacent said armature in a normal position of said armature and said magnet while attracting said armature, resilient means bearing upon said armature and tending to maintain both said armature and said magnet in said normal position, and actuating means coupled with said magnet for displacing the latter from said normal position in a direction tending

to remove said hammer from said carrier against the force of said resilient means, said armature being mounted for limited entrainment in said direction whereby continuing displacement of said magnet by said actuating means separates said armature from said magnet and enables said resilient means to propel said armature beyond said normal position into a position of marking contact between said hammer, said recording medium and said carrier.

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