

Jan. 28, 1941.

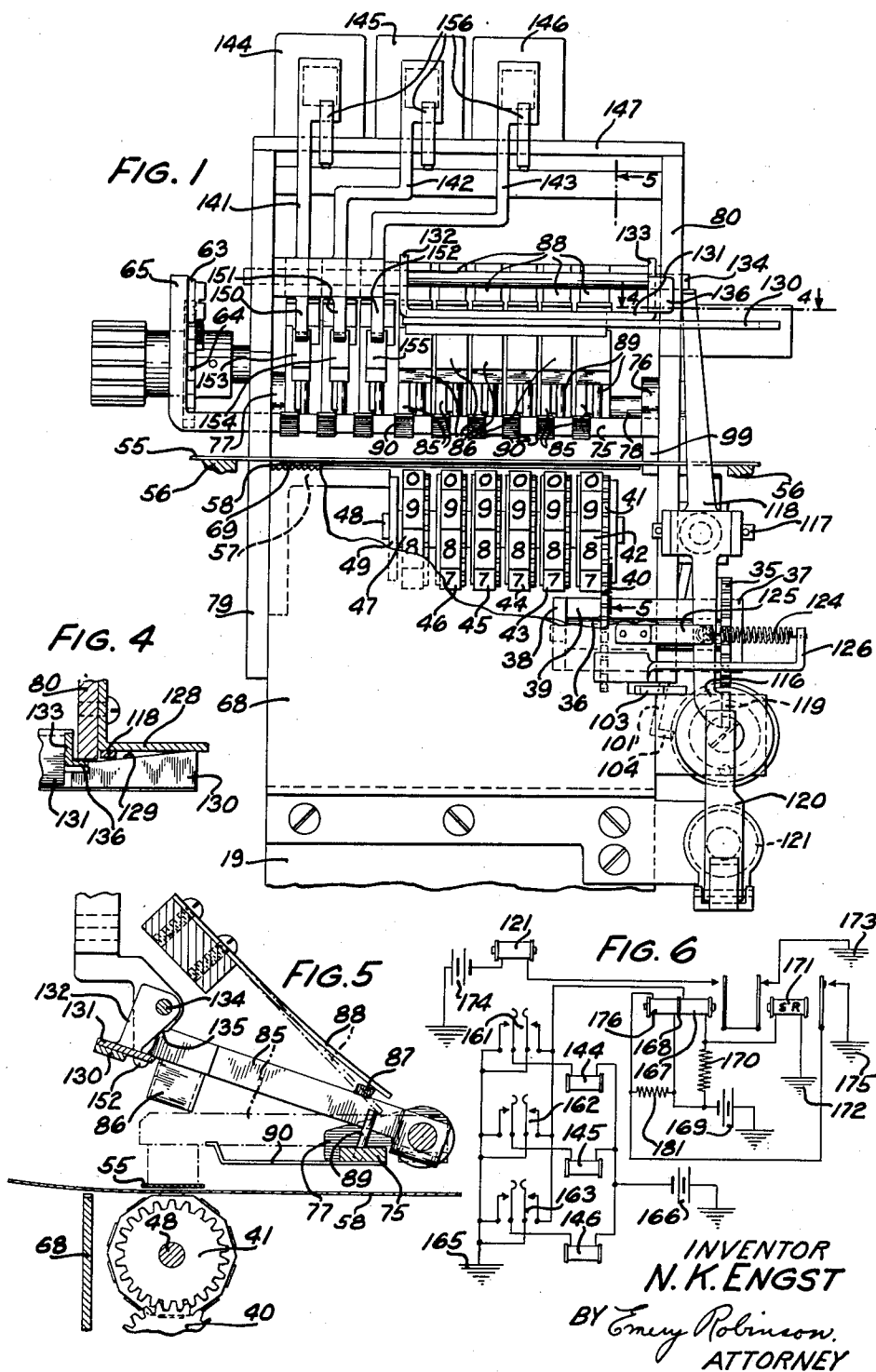
N. K. ENGST

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RECORDING APPARATUS

Filed July 10, 1937

2 Sheets-Sheet 1



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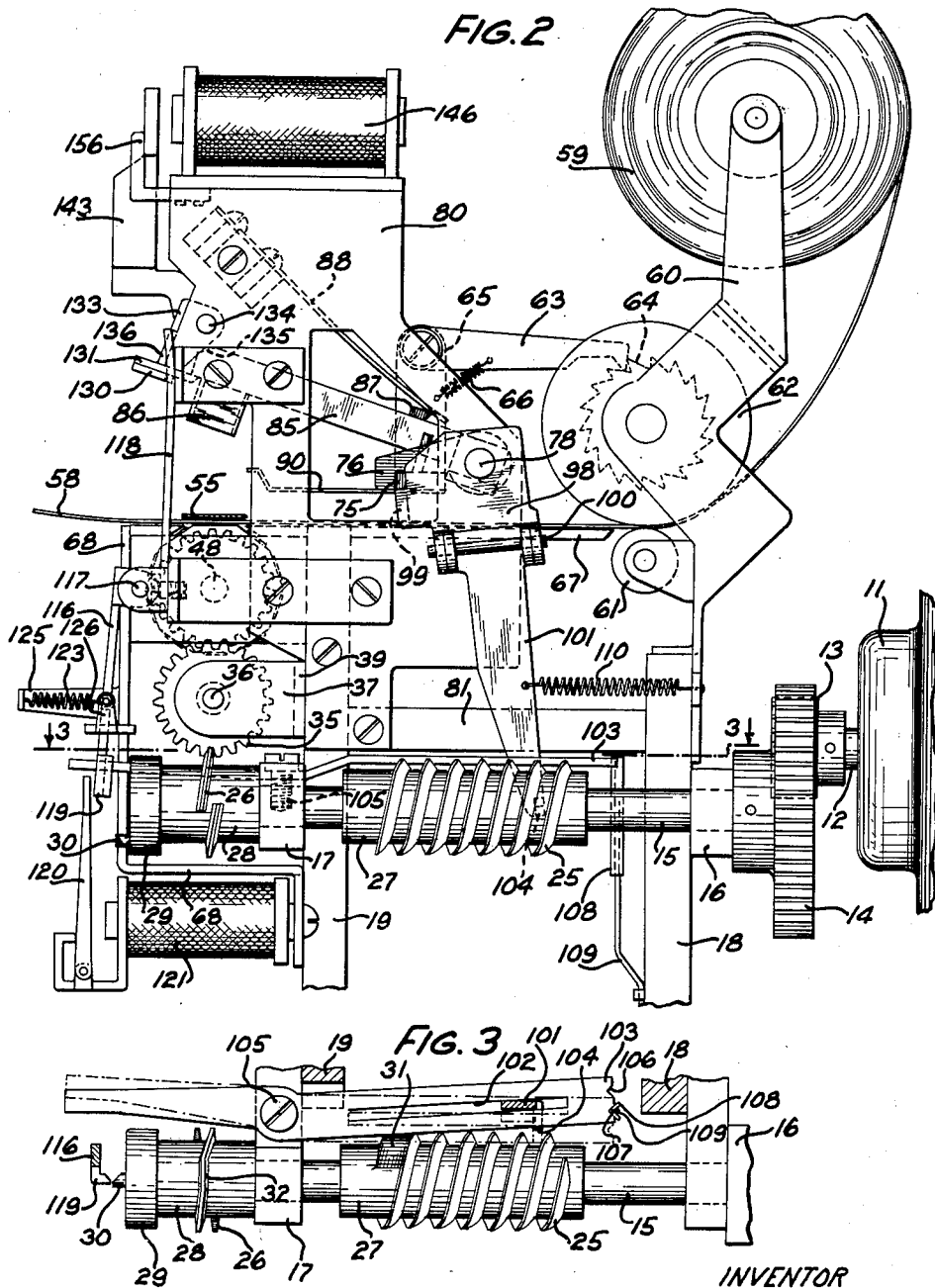
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UNITED STATES PATENT OFFICE

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RECORDING APPARATUS

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2 Claims. (Cl. 234—36.5)

This invention relates to recording apparatus and more particularly to apparatus for recording with precision the time of the occurrence of certain events.

5 In making time studies in connection with industrial research, it sometimes is desirable to measure with accuracy the time elapsing between the start and finish of assembly operations. Heretofore, measurements of this type were made by mechanisms which recorded the time by 10 punching holes in a tape fed at a constant rate of speed and bearing indicia representing time. This type of a record required interpolation before the information could be used in compiling 15 data, and it therefore became desirable to produce this data in a more conveniently read form.

It is an object of the present invention to provide a simple mechanism for recording accurately the time of occurrence of certain events.

20 One embodiment of the present invention contemplates the provision of mechanism for producing automatically a printed record of the time of occurrence of events, wherein a synchronous motor drives a counter having a plurality of decimal orders of counter wheels which carry raised 25 type on the periphery thereof representing minutes and decimal fractions of a minute. The drive for the counter wheels is designed so that the wheels will be held stationary for a short 30 time each time a new number is presented at a printing position. At the printing position there are provided hammers normally latched in an inoperative position, but which may be tripped electrically at the starting or stopping of any sequence of events, the time of which is to be 35 measured, and immediately upon release of the hammers they will strike a strip of paper fed step by step for each recording operation to drive it into engagement with an inked ribbon interposed 40 between the paper and the type on the counter wheels. Immediately upon the release of the hammers, to make a record, resetting instrumentalities are brought into play which serve to reset the hammers to their inoperative position, 45 from which they may again be released electrically. An auxiliary platen is located adjacent the number wheels so that identifying indicia may be selectively recorded adjacent the number which represents the time of occurrence of an 50 event for purposes which will become apparent as the detailed specification progresses.

55 A better understanding of the invention may be had by reference to the following detailed description, when considered in conjunction with the accompanying drawings, wherein

Fig. 1 is a front elevational view of a recording mechanism built in accordance with the preferred embodiment of the invention, parts being broken away to more clearly illustrate the structural features of the apparatus;

Fig. 2 is a side elevational view of the structure shown in Fig. 1;

Fig. 3 is a fragmentary transverse sectional view taken along the line 3—3 of Fig. 2 in the direction of the arrows;

Fig. 4 is an enlarged fragmentary sectional view, taken along the line 4—4 of Fig. 1 in the direction of the arrows;

Fig. 5 is an enlarged fragmentary sectional view taken along the line 5—5 of Fig. 1 in the direction of the arrows; and

Fig. 6 is a circuit schematic of an electrical control system for controlling the operation of the mechanism disclosed in Figs. 1 to 5, inclusive.

Referring now to the drawings, wherein like reference characters designate the same parts throughout the several views, the numeral 11 indicates a synchronous motor, which, when connected to a suitable source of current supply, will drive a shaft 12 at 1800 revolutions per minute. 25 The shaft 12 carries at its left end, (Fig. 2) a gear 13, meshing with gear 14, the respective sizes of the two gears being such that the gear 14 will be driven by the gear 13 at 1,000 revolutions per minute. The gear 14 is mounted upon a shaft 30 15, suitably journaled in bearings 16 and 17 mounted upon a pair of support plates 18 and 19, respectively.

A worm-type cam 25 is formed on a sleeve 27, fixed to the shaft 15 between the support plates 18 and 19, and a worm gear 26 is formed on a sleeve 28 secured to the shaft 15 adjacent its left end (Figs. 2 and 3). The worm-type cam 25 has the left end (Fig. 3) of its thread filled with a cam 31 for camming a member traveling 40 in the thread away from the worm when it approaches the end thereof. The shaft 15 carries at its extreme left end a cap 29 having fixed thereto a tapered pin 30, the function of which will be described hereinafter. 45

Meshing with the worm gear 26 is a gear 35 mounted upon a shaft 36 journaled in extending portions 37 and 38 of a U-shaped bracket 39 fixed to the support plate 19. The worm gear 26 has a portion 32 of its thread formed at right 50 angles to the axis of rotation of the shaft 15 so that the gear 35 will stand stationary at a predetermined time in each one-tenth revolution. The shaft 36 also carries a gear 40 for meshing with and driving a gear 41 fixed to the first or 55

lowest denominational order counter wheel 42. This counter wheel 42 has associated therewith second, third, fourth, fifth and sixth or highest denominational order counter wheels 43, 44, 45, 46 and 47, respectively. The counter wheels 42 to 47, inclusive, are mounted upon and freely rotatable about a shaft 48 mounted in a supporting bracket 49, which is in turn positioned upon the support plate 19. The counter wheels 42 to 47, inclusive, are equipped with a suitable carryover mechanism, not shown, which may be any of the well-known mechanical carryover mechanisms adapted to impart one-tenth of a revolution to a higher order counter wheel when its next lower order counter wheel passes from its 9th to its zero position. The periphery of each of the counter wheels is decagonal in shape, each of the flat portions thereof having raised type formed thereon representing one of the digits from one to nine or zero in numerical sequence.

The counter wheels are thus geared together in a ten to one relationship, and if it be assumed that the shaft 15 is driven at 1,000 revolutions per minute, then the counter wheel 42 will be advanced step by step at the rate of 100 revolutions per minute, presenting the numbers one to 9 and zero at a printing station at the rate of 1,000 numbers a minute, and the counter wheel 43 will be driven through ten revolutions in each minute, the wheel 44 will be driven through one revolution per minute, the wheel 45 will be driven through one-tenth of a revolution per minute, the wheel 46 will be driven through one-hundredth of a revolution per minute, and the wheel 47 will be driven through one-thousandth of a revolution per minute. In this manner, the numbers presented at a predetermined radial point with respect to the counter wheels will represent time in minutes and decimal fractions of minutes, the type on the lowest order wheel 42 representing thousandths of a minute.

Suspended directly above the counter wheels and carried by a pair of supports 56—56, is an inked ribbon 55 which may be fed in any suitable manner to present newly inked surfaces to the counter wheels as necessary. This inked ribbon extends above the counter wheels and a platen 57 positioned to the left of the counter wheels (Fig. 1), the purpose of which will become apparent as the description progresses. A strip of paper 58 is interposed between the inked ribbon 55 and the counter wheels 42 to 47 and platen 57. This strip of paper is fed from a supply roll 59 rotatably mounted on a bracket 60 and passes between an idler roller 61 and a feed roller 62, adapted to be driven by a pawl 63 and a ratchet 64. The pawl 63 is pivotally mounted upon an upwardly extending arm 65, being normally urged into engagement with the ratchet 64 by a spring 66 pinned to the pawl 63 and arm 65. A plate 67 serves to support the paper 58 between the portion thereof engaged by the rollers 61 and 62 and the counter wheels and platen 57. A bracket 68, having a serrated edge 69, is mounted upon the support plate 19 and bent to the left (Fig. 2) and then upwardly to support the extending end of the paper and to provide a surface against which the paper may be torn when it is desired to sever a portion thereof from the supply.

The arm 65, which supports the pawl 63, is formed integrally with a bar 75 fixed to a pair of arms 76 and 77, pivotally mounted on a rod 78. The rod 78 is mounted in a pair of side members 79 and 80, which are in turn supported

upon the support plate 19 and a spacing plate 81 fixed to the support plates 18 and 19. Also pivoted upon the rod 78 are a number of printing hammers 85, there being one hammer 85 for each counter wheel and each hammer being equipped with a ribbon engaging portion 86 for striking the inked ribbon 55 upon the release of the hammers. Each of the hammers 85 carries a projection 87, which is normally engaged by a relatively strong flat spring 88 to normally urge the hammers downwardly into engagement with the inked ribbon 55. However, the hammers, when they are in their lowermost position, as indicated by the dot and dash lines in Fig. 5, will not be held against the ribbon by the springs 88 due to the fact that a series of pins 89 have been mounted in the bar 75 adjacent to each of the hammers and after a hammer has been snapped downwardly by its spring 88, the spring will strike against its associated pin 89 and a series of relatively light springs 90 will hold the hammer out of engagement with the inked ribbon 55. In this manner, any hammer which has been snapped down by the spring 88 will strike the inked ribbon 55 and immediately upon its rebound will be held in a position just above the ribbon 55 and will not hold the ribbon against the paper 58, whereby the hammers will be snapped into engagement with the inked ribbon and will immediately rebound from the ribbon and will be held up by the spring 90. The springs 90 are carried by the bar 75.

Mounted at the right side (Fig. 1) of the rod 78 is a hinged plate 98 (Fig. 2) having a portion 99 thereof bent over to extend under the forward edge of the bar 75. This hinged plate 98 has hinged thereto at 100 an actuating member 101, which extends through a slot 102 in a pivoted lever 103 (Figs. 2 and 3) and which carries a projection 104 adapted to be moved into the worm-type cam 25 upon actuation of the lever 103. The actuating member 101 is normally held in the position shown in Fig. 2 by a spring 110. The lever 103 is pivoted at 105 to the bearing 17 and has a pair of notches 106 and 107 formed in the right end thereof (Fig. 3) for receiving a V-shaped member 108 mounted upon a leaf spring 109 secured to the support plate 18 whereby the lever 103 will be held in either of two adjusted positions, one of which is shown in dot and dash lines and the other of which is shown in solid lines (Fig. 3). The left end of the lever 103, (Figs. 2 and 3) extends into the path of a hinged lever 116, which is hinged at 117 to a hinge plate 118. The lower end of the hinged lever 116 carries a projection 119 which may be moved into the path of the tapered pin 30 by the armature 120 of an electromagnet 121. The projection 119 of the hinged lever 116 is tapered as shown in Fig. 3 to cooperate with the tapered pin 30 and the lever 116 is normally pulled toward the left (Fig. 2) about its pivot 117 by a coil spring 123. The lever 116 is also normally urged to the right (Fig. 1) by a coil spring 124, suitable brackets 125 and 126 being provided for supporting the springs 123 and 124, respectively. The spring 124 normally tends to hold the upper end of the hinge plate 118 against the side member 80. However, when the projection 119 is moved into the path of the tapered pin 30 by energizing the electromagnet 121, the hinge plate 118 will be rocked in a clockwise direction by pin 30 to move its upper end away from the plate 80. A bracket 128 is mounted upon the plate 80 to prevent displacement of the

hinge plate 118 toward the rear of the machine (upward in Fig. 4) so that the hinge plate 118 will cooperate with a cam surface 129 formed on a plate 130 which is connected to a latching member 131. The latching member 131 has upwardly turned ends 132 and 133 by means of which it is pivoted eccentrically upon a rod 134 extending between the side members 79 and 80. The latching member 131 normally tends to rock under the force of gravity in a counter-clockwise direction about the rod 134 and into the path of the printing hammers 85 which have cam surfaces 135 on their left ends (Figs. 2 and 5). A bent-over portion 136 of the latching member 131 normally engages the front edge (Fig. 1) of the side member 80 to hold the latching member 131 in position to be cammed to the left (Figs. 2 and 5) by the printing hammers 85 as they are moved upwardly. The pin 30 is so positioned on the cap 29 that the tripping of the latching member 131 will take place at the instant that the portion 32 of worm gear 26 is in engagement with the gear 35, whereby the type on the counter wheels being stationary will make a clear impression on the paper.

Pivotaly mounted on the rod 134 are the armatures 141, 142, and 143 of three electromagnets 144, 145 and 146, respectively, mounted upon a plate 147 extending across the top of the side members 79 and 80. The armatures 141, 142 and 143 are pivoted eccentrically on the rod 134 and the weight thereof tends normally to move the upper end of them away from their associated electromagnets to carry latching members 150, 151 and 152, respectively, under the extending ends of printing hammers 153, 154 and 155 having raised type formed on the lower faces thereof, which, upon the release of the respective hammers, will strike the inked ribbon 55 and cause the letters C, B or A to be printed on the paper 58 in alignment with the numbers to be printed thereon through the coaction of the printing hammers 85 and the counter wheels 42 to 47. Brackets 156 are secured to the plate 147 for preventing the armatures 141, 142 and 143 from rocking counter-clockwise (Fig. 2) beyond a predetermined position where they can be cammed by the edges of their associated hammers 153, 154 and 155.

The circuit for controlling the operation of the recorder, the mechanical features of which have been described in detail hereinbefore, will be described in connection with the operation of the apparatus. The apparatus may be used for the timing of the various mechanical operations by providing a series of switches 161, 162 and 163 which have been shown in Fig. 6 as keys. These switches may be controlled manually or may be controlled by a fixture, not shown, which holds an article being assembled in such a manner that when the fixture is placed in front of an operator, a switch will be operated. The operation of any one of the switches 161, 162, or 163 will energize their associated electromagnets 144, 145 or 146 by completing the circuit from ground at 165 through the winding of the electromagnet associated with the switch to grounded battery 166, thereby rocking the armature of the operated electromagnet about the rod 134 to release the printing hammer 153, 154 or 155 from its associated latch 150, 151 or 152, respectively. When one of the latches 150, 151 or 152 releases its associated printing hammer 153, 154 or 155, the spring 88 associated therewith will snap the ham-

mer down into engagement with the inked ribbon 55 to cause the letter C, B or A to be printed on the strip of paper 58.

Simultaneously with the closing of the circuit through the left-hand pair of contacts of the operated switch 161, 162 or 163, the right-hand contacts of the switch will close a circuit from ground at 165 through a winding 167 of a double wound relay 168 and through a 1,000 ohm resistance 170 to grounded battery at 169. A relay 171, having one side of its winding connected to ground at 172, and having 1,000 ohms resistance, has the other side of its winding connected through the 1,000 ohm resistance 170 to grounded battery 169 and is therefore normally held energized. The relay 171 has ground at 173 connected to its normally made make contact and ground at 175 connected to its normally open break contact and therefore when double wound relay 168 has its winding 167 energized by the closing of one of switches 161, 162 or 163, the ground at 173 will be momentarily connected through the make contacts of the relays 168 and 171 to the winding of electromagnet 121. The electromagnet 121 is constructed to release slowly enough to hold the hinged lever 116 in the path of the pin 30 long enough to insure that the tripping of the latch member 131 and the initiation of the resetting operation of the printing hammers 85 will take place, each time the electromagnet operates. As soon as the double wound relay 168 is completely energized, the winding of relay 171 will be shunted and the relay 171 will release to open the circuit through its normally closed make contact and to close its normally open break contact. When the break contact of relay 171 closes, it will connect ground at 175 through a winding 176 of the relay 168 to grounded battery 169. A 1,000 ohm resistance 181 is connected across the winding 176 of the relay 168, which winding has a resistance of 1,300 ohms, and consequently, when the operated switch 161, 162 or 163 is opened, due, for example, to the removal of the fixture from the position previously occupied in front of the operator, the ground path for holding the winding 167 of double wound relay 168 energized will be broken and the winding of relay 171 will no longer be shunted. However, relay 168 will not release immediately since its winding 176 is still energized over the path through the break contact of relay 171 to ground at 175, but will stay energized until relay 171 is energized over the circuit from grounded battery at 169 through the 1,000 ohm resistance 170 and winding of the relay 171 to ground at 172, thereby transmitting another pulse to the electromagnet 121 and breaking the ground connection at 175 from the winding 176 of relay 168. In this manner, a pulse of short duration will be transmitted to the electromagnet 121 and the control circuit will be restored to the condition shown.

Each time the electromagnet 121 is operated, the following cycle of operations will automatically take place:

When the electromagnet 121 is energized, it will attract its armature 120 thereby to rock the hinged lever 116 about the hinge plate 118 in a counter clockwise direction (Fig. 2) to move the knife edged projection 119 into the path of the tapered pin 30, whereupon, as the pin is moved through its circular path due to the rotation of the shaft 15, the hinged lever 116 and its associated hinge plate 118 will be rocked in a clockwise direction (Fig. 1) about the pivot there-

by to move the upper portion of the plate 118 to the right (Fig. 4). The upper end of the hinge plate 118 in moving to the right (Figs. 1 and 4) will cam the plate 130 away from the bracket 128, thereby to move the latching member 131 out from under the extending ends of the printing hammers 85. Upon the release of the printing hammers 85, they will be snapped downwardly by their associated springs 88 to strike the inked ribbon 55 and drive it and the paper 58 into engagement with the type on the counter wheels 42 to 47, thereby to print the number composed of those digits on the type wheels which are in their uppermost position. As the hinged lever 116 rocks in a clockwise direction, it engages the left end (Fig. 3) of the pivoted lever 103 to rock it about its pivot 105 to the position shown in dot and dash lines (Fig. 3) carrying with the lever 103 the actuating member 101 and moving the projection 104 into the thread of the worm type cam 25. When the pivoted lever 103 is thus rocked to its dot and dash position, it will be held in that position by the V-shaped member 108 and the lower end (Fig. 2) of the actuating member 101 will be driven to the left (Figs. 2 and 3) to rock hinge plate 98 about the rod 78 thereby to cause the portion 99 of the hinge plate 98 to raise the left edge of the bar 75 and move all of the hammers 85 upwardly to the point where their cam surfaces 135 will engage the latching plate 131 to move it to the left (Fig. 2) until the hammers have moved upwardly a sufficient distance for the latching member 131 to drop under the forward edges of the hammers. As soon as the hammers are all latched in their upper position, as shown in Figs. 2 and 5, where the springs 88 will be under tension tending to snap the hammers downwardly, the projection 104 will engage the camming member 31 and will be moved to the left (Fig. 1) (upwardly in Fig. 3) to cam the pivoted lever 103 out of its dotted line position, where it has been held by the V-shaped member 108, into its full line position (Fig. 3), whereupon the actuating member 101 will be returned to its normal position, as shown in Fig. 2, by the

spring 110. Thus the printing mechanism will be restored to its normal position and ready to receive a pulse for initiating a printing and resetting cycle.

The machine operating in the manner just described will record with a high degree of accuracy the time of the occurrence of any desired event upon simply closing a pair of contacts and indicia identifying the type of event which has occurred will be printed by selected ones of the hammers 153, 154 and 155 and the entire device will be automatically reset in a very short interval of time.

While in the present embodiment of the invention a particular type of mechanism has been disclosed, it will be obvious that many modifications and adaptations of the invention could be made without departing from the scope of the appended claims.

What is claimed is:

1. In a recorder, a shaft driven at a predetermined rate of speed, a counter mechanism driven by said shaft and having type associated therewith, a series of printing hammers, means for normally holding said printing hammers away from said type, means for normally urging the printing hammers into engagement with said type, means for releasing said printing hammers, and means controlled by said releasing means for resetting the hammers to their normal position.
2. In a recorder, a shaft driven at a predetermined rate of speed, a counter mechanism driven by said shaft and having type associated therewith, a series of printing hammers, means for normally holding said printing hammers away from said type, means for normally urging the printing hammers into engagement with said type, means for releasing said printing hammers, means controlled by said releasing means for resetting the hammers to their normal position comprising a member common to said hammers, a cam device mounted on said shaft, and a pivoted and rockable lever interconnecting said common member and said cam device.

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