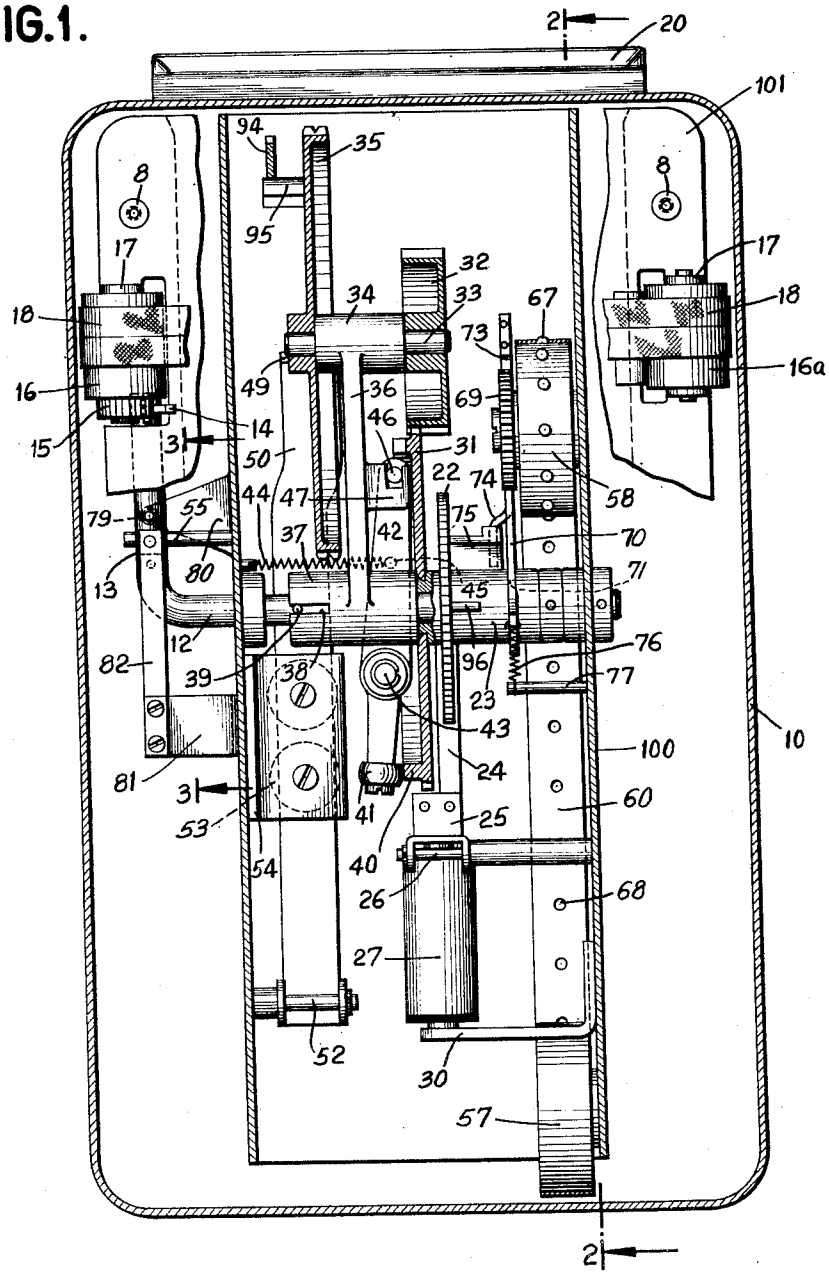
May 6, 1941. T. E. TORKELSON 2,240,587

CARD TIME RECORDER

Filed Sept. 14, 1938 4 Sheets-Sheet 1

FIG.1.



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CARD TIME RECORDER

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FIG.2.

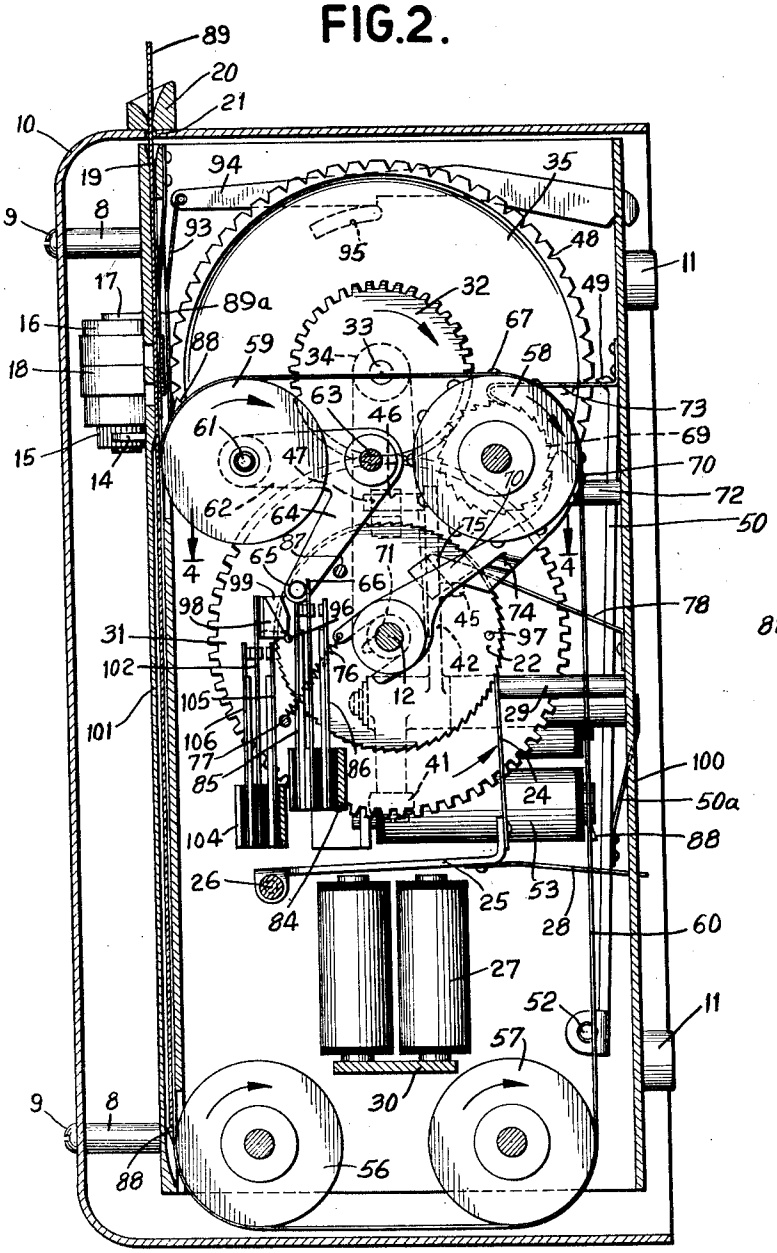
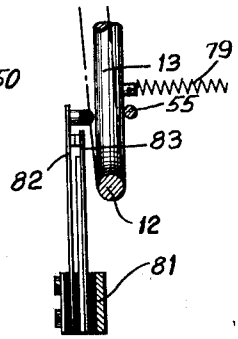


FIG.3.



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CARD TIME RECORDER

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FIG.4.

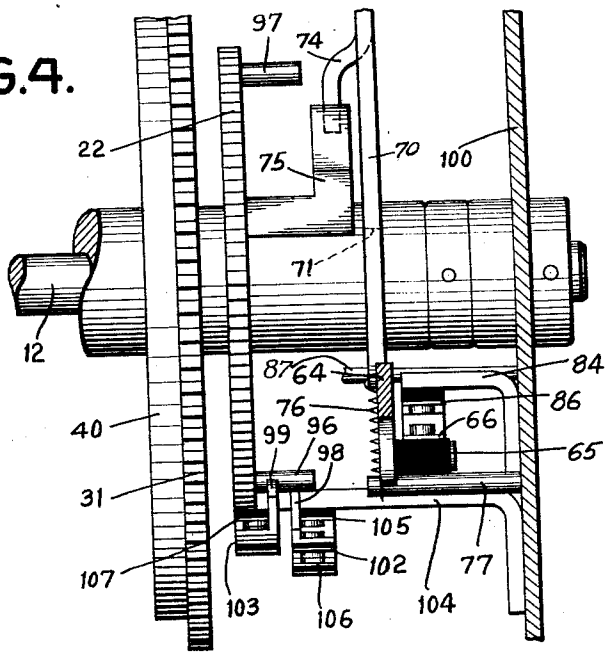
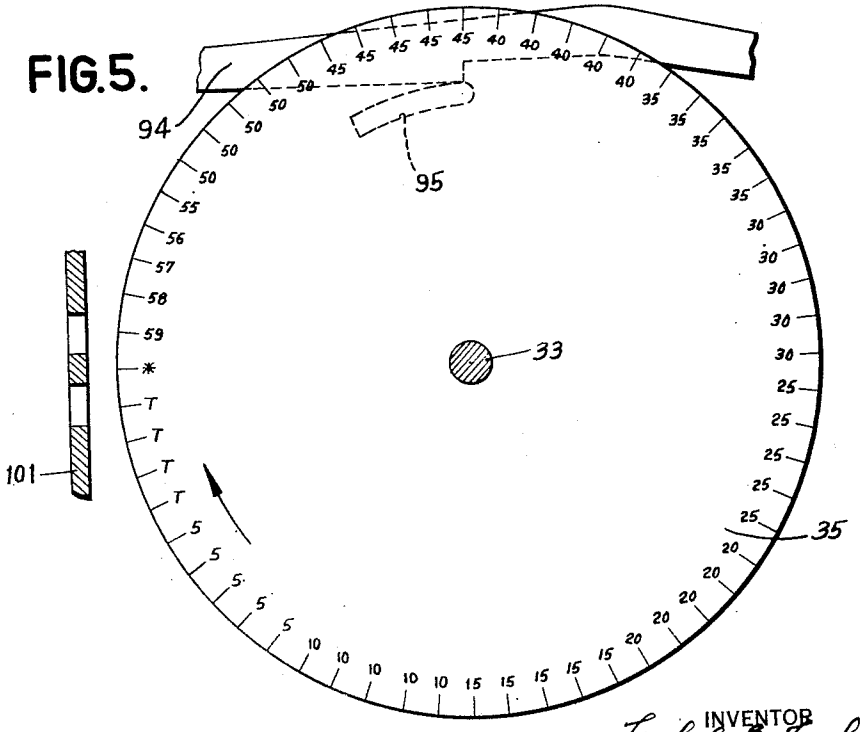


FIG.5.



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CARD TIME RECORDER

Filed Sept. 14, 1938 4 Sheets-Sheet 4

FIG.6.

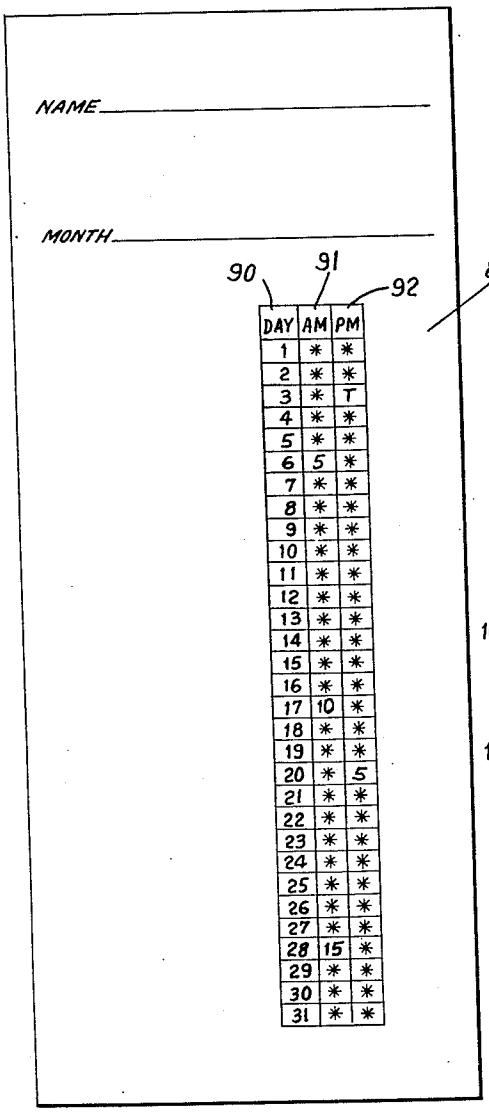
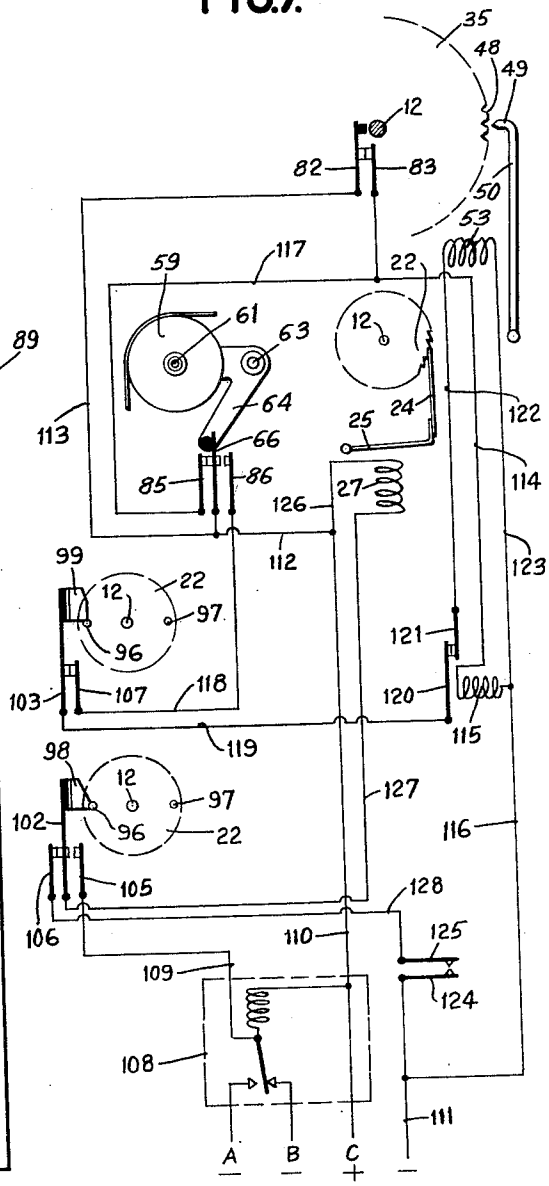


FIG.7.



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UNITED STATES PATENT OFFICE

2,240,587

CARD TIME RECORDER

Torkel Edwin Torkelson, Baldwin, N. Y., assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application September 14, 1938, Serial No. 229,823

5 Claims. (Cl. 234—43)

The present invention relates to time recorders and more particularly to time recorders in which a record is made on a card automatically upon the insertion of the card into printing position.

It is proposed according to the invention to provide a simple form of time recorder which is particularly adapted for keeping the attendance records of school children. The operation of the device is made easy by arranging mechanism which will automatically print a time record on a card in response to the mere insertion of the card into the machine. The printed record prepared by the machine is simplified to a degree which makes it intelligible to very young children. Any "on time" record is made by simply printing an asterisk or star on the card regardless of the time of day at which it is made. Tardiness of a few minutes is recorded by printing another simple symbol, for example, a "T." More serious tardiness, for example, tardiness of more than five minutes is recorded by printing the number of minutes which the pupil is late in multiples of five. It is preferred to arrange the record so that attendance for a complete month may be recorded on a single card, one line being assigned to each day. This arrangement makes it possible to check a month's complete attendance by merely glancing at the card.

The recorder is made simple in structure and cheap to manufacture by novel arrangements of mechanisms to properly locate the card according to the day of the month and to cause the insertion of the card to operate printing devices to make a record on the card. Preferably, an endless tape or belt is provided which is moved in steps, day by day, and which carries projections to act as stops to govern the extent to which a card may be inserted into the machine. The same projections or stops cooperate with the card to effect operation of the printing mechanism in response to a very slight pressure of the card against them.

It is an object of this invention to provide a time recorder for indicating the elapsed amount of time a person is late in registering after each of a plurality of preselected times up to a predetermined amount of elapsed time.

Another object is to provide a time recorder for printing data on a card automatically upon the insertion of the card into printing position during each of a plurality of intervals comprised of a predetermined period of time prior to each of a plurality of preselected times and a predetermined period of time thereafter, said recorder being inoperative in between said intervals.

It is a further object of the invention to provide a time recorder for printing data on a card in which an endless tape is used for positioning the card in printing position.

A still further object of the invention is to provide a time recorder for printing data on a card in which an endless tape is used for positioning the card and for causing the printing means to be operated.

The latter object more specifically includes the provision of a resilient support for the tape to be moved in response to pressure exerted on the card and means operable by movement of the support to effect a printing operation.

Another object of the invention is to provide a time recorder which indicates "on time" registrations in non-time indicating indicia and "tardy" registrations during a predetermined elapsed time by another non-time indicating indicia and which indicates "late" registrations made after said "tardy" registrations in time indicating indicia denoting time elapsed from the preselected time set for "on time."

It is a further object to provide a time recorder for printing data characteristic of certain periods of time on a card in which identical data may be printed for different periods of time whereby the different periods may be differentiated only by the position of the printed data on the card.

Various other objects and advantages of my invention will be obvious from the following particular description of one form of mechanism embodying the invention or from an inspection of the accompanying drawings; and the invention also constitutes certain new and novel features of the construction and combination of parts hereinafter set forth and claimed.

In the drawings:

Fig. 1 is a front view of the machine with a portion thereof in section.

Fig. 2 is a side view along line 2—2 of Fig. 1 with the direction of rotation of various gears and wheels indicated by arrows.

Fig. 3 is a detail showing a partial section along line 3—3 of Fig. 1.

Fig. 4 is a detail of a portion of the machine showing the relation of the time controlled switches and the card actuated switch as viewed along line 4—4 of Fig. 2.

Fig. 5 shows diagrammatically the arrangement of type on the typewheel.

Fig. 6 illustrates a typical card record.

Fig. 7 is a wiring diagram showing certain related parts diagrammatically.

Referring now to Figs. 1 and 2, a U-shaped supporting frame 100 is provided with its open side to the front and having flanges extending outwardly to which is secured a front plate 101 by means of studs 8 which have threaded ends entering threaded holes in the flanges. The outer ends of the studs are drilled and threaded to receive screws 9 which hold the outer case or housing 10 in position. Spacing collars 11 are fixed to the back of the supporting plate 100 having holes through the center thereof in alignment with holes in the back of the plate to receive mounting screws for suitably fastening the recorder to a supporting structure.

The front plate 101 is spaced, by suitable means such as shims, from the turned out flanges of the U-shaped supporting structure 100 sufficiently to permit a record card to be inserted into the machine with the edges of the record card sliding in this space which serves as a card guideway. This space is indicated in Fig. 2 by the reference numeral 19. A card receiver 20 is fixed to the housing 10 adjacent an aperture 21 and the card receiver and aperture are held in the plane of the card guideway 19 when the housing is fastened in place.

A spindle 12 is journaled in the supporting frame of the machine and has an upturned portion 13 which carries at its upper end a pawl 14 cooperating with a ratchet wheel 15 which is fixed to the ribbon spool 16. A similar ribbon spool 16a is mounted on the opposite side of the machine. These spools are rotatably supported by extensions 17 formed from the plate 101 and carry an endless two-colored ribbon 18.

A ratchet wheel 22 is fixed to a bushing 23 which is rotatably mounted on spindle 12. A spring pawl 24 cooperates with the ratchet wheel and the pawl is fixed to the armature 25 which is pivoted at 26 and associated with the magnet 27. Another spring pawl 78 engages ratchet 22 to prevent its turning when pawl 24 is moved downward to engage another tooth. A leaf spring 28 which passes through a slot in the supporting structure 101 is fixed to armature 25 to normally force the spring pawl 24 upward the uppermost position of the pawl being fixed by wedging action between a tooth of the ratchet wheel and a limit stop 29. The magnet 27 is mounted on a supporting bracket 30 fixed to the frame 100.

A gear 31 is also mounted on the bushing 23 and meshes with a gear 32 which is secured to a shaft 33 journaled in a bearing 34, said shaft also having a typewheel 35 fixed thereto. The bearing 34 is integral with an arm 36 having a second bearing 37 integral with its opposite end and slidably mounted on the spindle 12. The bearing 37 is provided with a slot 38 cooperating with a pin 39 fixed to the spindle 12. This permits the bearing 37 to be moved longitudinally of and relative to the spindle 12 but any rotary motion of said bearing about the axis of the spindle 12 will cause the spindle to rotate with it.

On one face of the gear 31 is mounted a cam member 40 which cooperates with a roller cam wiper 41 mounted on one end of a lever 42. This lever is pivoted at 43 and biased in a counterclockwise direction by a spring 44 fastened to a post 45 on the lever and to the side frame of the supporting structure. The upper end of lever 42 is provided with a pin 46 which engages a slot in a projection 47 integral with the arm 36. When the lever 42 is oscillated about its pivot by the cam 40, the arm 36 is shifted on the spindle 12 thereby moving the typewheel to the left or right according to the position of the cam 40. In Fig. 1 the typewheel is shown in its extreme right position.

The typewheel 35 is provided with notches 48 between adjacent type characters, which are adapted to receive the pointed end 49 of an armature lever 50 pivoted at 52 and associated with a magnet 53 attached to the supporting frame by a bracket 54. When the magnet 53 becomes energized the armature 50 is moved to the left and the point 49 engages one of the notches of the typewheel 35 moving the whole type wheel to the left against the ribbon 18 to effect printing on a card inserted in the machine. The typewheel and its bearing 34 swing about the axis of the spindle 12 and by virtue of the pin and slot connection 38 and 39 cause the spindle 12 to turn. This rotation of spindle 12 moves the arm 13 to cause the pawl 14 to engage another tooth in the ratchet wheel 15, whereby the ribbon is fed upon the return of the arm 13. A spring 79 is connected to the arm 13 and anchored to an ear 80 turned out from the supporting frame 100 to return the arm 13 and typewheel 35 to their normal positions after printing has been effected. A limit stop 55 fixed to the supporting frame limits the return movement of the arm 13. A leaf spring 50a returns lever 50 as soon as magnet 53 is deenergized.

It is to be noted that during the printing operation while point 49 is engaged with a notch 48 on the typewheel, the typewheel will be held against rotation about its center. Therefore, if magnet 27 should release arm 25 to effect movement of ratchet 22, and consequently the typewheel, while printing was in progress, the spring 28 could not turn the ratchet until the printing was over, thereby avoiding blurring the print.

Carried on an insulated bracket 81 mounted on frame 100 is a switch including a contact carrying spring 82 (Fig. 3) and a contact arm 83. Thus when the typewheel is moved to effect printing, spring 82 will be moved to separate the contacts.

Four pulley wheels 56, 57, 58 and 59 are provided over which an endless tape 60 is passed. The pulley wheels 56, 57 and 58 are rotatably mounted on spindles carried by the supporting frame. Wheel 59 is pivotally mounted on a stud 61 carried by one arm 62 of a bell crank pivoted on a stud 63 mounted on the supporting frame. The other arm 64 of the bell crank carries a pin 65 of suitable insulation which bears against a leaf spring 66. This spring 66 biases the bell crank in a clockwise direction to keep the tape 60 taut. The wheel 58 is provided with sprocket pins 67 which engage holes 68 disposed along the center line of the tape 60 in order to properly move the tape when the wheel 58 is driven. A ratchet wheel 69 is fixed to the wheel 58 and is engaged by a pawl 70. The pawl 70 has a V-shaped end which engages an annular groove 71 in the bushing 23 and is slidable therein. The upper end of the pawl 70 rests on the stud 72 which also acts as a limit stop and means for locking the ratchet wheel 69. A spring pawl 73 engages the ratchet wheel 69 to prevent its turning when the pawl 70 is moved upward to engage an advance tooth of the ratchet wheel. An offset 74 integral with the pawl 70 and disposed in the orbit of a cam member 75 is adapted to be engaged periodically by this cam member as it rotates in a counterclockwise direction as viewed in Fig. 2. The pawl 70 is biased to the left and

in a counterclockwise direction by a spring **76** anchored to a stud **77** fixed to the supporting frame. As the cam member **75** is rotated it moves the pawl **70** to the right and the spring **76** causes it to pivot about the spindle **12** to engage the next tooth of the ratchet wheel **69** and as the cam member passes the spring **76** retracts the pawl **70** to advance the ratchet wheel **69** and therefore the sprocket wheel **58** to move the tape **60**.

Leaf spring **66** is mounted on bracket **84** as are arms **85** and **86** on each side of spring **66** and these arms carry contacts for cooperation with contacts carried by the spring, the bracket **84** being secured to the frame. Thus, movement of spring **66** back and forth by arm **64** of the bell crank will cause switch **66—85** to be closed and then opened as switch **66—86** is closed for purposes which will be explained in connection with the wiring diagram. A pin **87** is fixed to the side of the frame and serves as a limit stop for arm **64**.

Three abutments **88** are carried on tape **60** which passes along the card guideway between wheels **56** and **59**, as can be seen in Fig. 2. These abutments are spaced so that one of them, but only one, will always be in said guideway. As the record card is inserted through receiver **20** it is guided by leaf spring **89***a* between the ribbon and the front plate and downward alongside the tape **60** until the bottom of the card engages one of the abutments **88**. Thereafter a slight pressure downward on the card will cause arm **64** to be swung against stop **87** closing switch **66—86** which will effect printing on the card as it is held in position by abutment **88**.

Referring to Fig. 6, a record card **89** will have certain data preprinted thereon including three vertical columns **90**, **91** and **92** headed "Day," "A. M." and "P. M.," respectively, and in the "day" column are listed numbers corresponding to the days in the month. In each of the other columns, a space is provided on each numbered day line in which a registration is to be made. The movement of tape **60** is so timed that each day the abutment **88** in the card guideway will be moved upward one step to position the card for printing on the proper day line. The machine illustrated is designed to use one card a month or 31 steps of the tape. At the end of months having less than 31 days, the tape may be moved ahead manually to provide a proper initial day printing position for the next month.

A ribbon guide **93** is attached to the end of lever **94** which is pivoted at its other end on frame **100**. A cam **95** is carried by the typewheel and is positioned to engage lever **94** and lift the two colored ribbon.

Two pins **96** and **97** are fixed 180 degrees apart on ratchet **22** and during the rotation thereof, they engage two cams **98** and **99** (Fig. 4) carried on the ends of leaf springs **102** and **103**, respectively. The springs **102** and **103** are mounted on insulated bracket **104** secured to the frame. Arms **105** and **106** are likewise mounted on the bracket **104** and extend along each side of spring **102**. Contacts are carried by arms **105** and **106** and spring **102** in such a manner that switch **102—105** is normally closed but engagement of cam **98** by either pin **96** or **97** will open that switch and close switch **102—106**.

Contact arm **107** is mounted alongside of spring **103** and its contact is normally engaged with one carried by said spring but is separated therefrom when cam **99** is engaged by either pin **96** or **97**. The portion of cam **75** adjacent to ratchet **22** is cut down to prevent operation of cams **98** and **99** thereby.

The machine illustrated in the drawings is designed for use as an attendance recorder in which a plurality of preselected times during the day are set for "on time" registrations, for example, 9 a. m. and 1 p. m. The machine is so arranged that from 8 a. m. through 9 a. m. a blue asterisk will be printed in the a. m. column; from 9:01 through 9:04 a. m. a blue T will be printed; from 9:05 a. m. through 9:55 a. m. the elapsed amount of time in steps of five minutes will be printed in red; and at 9:56 a. m. the machine will become inoperative and remain so until 12 noon at which time the sequence will be repeated with the printing being done in the p. m. column on the cards. A typical series of registrations is shown in Fig. 6 from which it can be seen that the individual to which that card was assigned registered between 8 a. m. and 9 a. m. every day except the 6th, 17th and 28th on which days he registered between 9:05 and 9:09; 9:10 and 9:14; 9:15 and 9:19, respectively. Further, he registered between 12 noon and 1 p. m. every day except the 3rd and the 20th on which days he registered between 1:01 and 1:04; 1:05 and 1:09, respectively.

To accomplish the aforementioned sequence, the type wheel has sixty divisions, each division carrying type as shown in Fig. 5 and appearing successively in the printing position at the rate of one division per minute between 9:01 and 9:59 a. m. and 1:01 and 1:59 p. m. in accordance with the electrical circuits which will now be described.

Referring to Fig. 7, the recorder is adapted to be tapped on to a secondary clock system indicated at **108**. The secondary clock has the usual A and B negative leads and the C positive lead from the master clock. The master and secondary clock systems employing these three leads are common and well known in the art and it is believed sufficient for present purposes to state that single electrical impulses are received once each minute from the master clock over leads C and A or B with the exception of certain abnormal faster impulses received between the 59th and 60th minutes for synchronization purposes when the secondary clock is slow.

Wire **109** is tapped into the secondary clock to connect with the negative leads A or B as the case might be; wire **110** is tapped to the positive C lead; and the main negative lead **111** is brought in for use in the recorder. The positions of the switches and cams shown in Fig. 7 are those occupied from 8 a. m. through 9 a. m., with the asterisk on the typewheel in position to print in the a. m. column and with the cam **95** on the typewheel engaging lever **94** to bring the blue portion of the ribbon into printing position. A circuit is then complete from wire **110** through wires **112** and **113**, closed switch **82—83**, wire **114**, release magnet **115**, wire **116** to negative lead **111**. There is also a circuit from wire **110** through wire **112**, closed switch **66—85**, wires **117** and **114**, magnet **115**, wire **116** to lead **111**. Magnet **115** forms a part of a control relay which also comprises switch **120—121**, the closing of the latter switch by the energization of magnet **115** being a condition precedent to the preparation or "release" of print magnet **53** for operation by circuits presently to be described. If a card is now inserted in the machine, arm **64** will swing spring **66** to the right breaking switch **66—85** and making switch **66—86**.

Although the circuit through switch 66—86 and magnet 115 is thus broken, the magnet will still remain energized through switch 82—83. The making of switch 66—86 will complete a circuit from wire 110 through wire 112, switch 66—86, wire 118, closed switch 107—103, wire 119, print release switch 120—121 held closed by magnet 115, wire 122, magnet 53, wires 123 and 116 to lead 111. This latter circuit energizes magnet 53 which pulls lever 50 to the left to move the typewheel and effect printing. Movement of the typewheel will open switch 82—83, deenergizing magnet 115 which allows switch 120—121 to open and break the circuit through magnet 53 to release lever 50 and permit a quick return of the typewheel resulting in a clear print. When the typewheel is returned and the card removed, switches 82—83 and 66—86 will again be closed to energize magnet 115 and switch 66—86 will be reopened.

An impulse switch 124—125 is actually to be operated in the well known manner by the customary impulse programming device of a master clock but is shown in the wiring diagram for clarity. The impulse switch 124—125 will be closed momentarily between 9:00 a. m. and 9:01 a. m. to close a circuit from wire 110 through wire 126, magnet 27, wire 127, switch 102—106, wire 128 and the impulse switch to the negative lead 111. Thus magnet 27 is energized pulling arm 25 downward for pawl 24 to engage another tooth in ratchet 22. At exactly 9:01 the master clock opens switch 124—125 deenergizing magnet 27 and permitting pawl 24 to turn ratchet 22 one step which will in turn rotate the typewheel one division to bring the first T into printing position.

Rotation of ratchet 22 one step at 9:01 will also move pin 96 past cam 98 opening switch 102—106 and closing switch 102—105. A circuit is then made from wire 110 through wire 126, magnet 27, wire 127, switch 102—105 to wire 109. As previously mentioned the master clock sends an impulse through this circuit once each minute which will advance ratchet 22, and therefore typewheel 35, one step each minute. Thus at 9:02 the second T will be moved into printing position and so on until 9:05 at which time the first 5 on the typewheel is moved into position and cam 95 moves away from lever 94 to move the red portion of the ribbon into printing position. At 9:10 the first 10 on the typewheel will move into printing position. The typewheel will continue to be stepped every minute and to print the time elapsed from 9:00 a. m. in multiples of five minutes until 9:56 a. m. It will be understood that anytime during this period, printing may be accomplished by operation of switch 66—86.

Ratchet 22 has 120 teeth so that it will be turned one-half revolution per hour of stepping. Gear 31 will be rotated at the same speed as ratchet 22 but will act through gear 32 to turn the typewheel 35 one revolution per hour. Therefore, at 9:56 pin 97 on ratchet 22 will engage cam 99 to open switch 107—103 breaking the printing circuit. The typewheel continues to be stepped once a minute but insertion of a card into the machine will not effect printing thereon.

From 9:56 a. m. through 9:59 a. m. cam 40 (Fig. 1) acts through roller 41 to move the typewheel into position to print in the p. m. column although the printing means remains inoperative during this time. At 9:59 a. m. pin 97 will engage cam 98 breaking switch 102—105 and closing switch 102—106. Thus the stepping mechanism is halted and it will remain inoperative until an impulse is received through switch 124—125. The master clock will send a single impulse through switch 124—125 to advance the ratchet one step at 12 noon. The typewheel will then rotate to bring the asterisk into printing position, cam 95 will engage lever 94 to bring the blue portion of the ribbon into position, and pin 97 will pass cam 99 closing switch 107—103. The printing means is thus rendered operable by the insertion of a card. Since pin 97 still engages cam 98, the typewheel is not stepped again until 1:01 p. m. when the master clock advances the mechanism one step and thereafter the mechanism is stepped regularly once each minute as described in connection with the a. m. operation. At 1:56 the switch 107—103 is broken and from 1:56 through 1:59 the typewheel is moved to position for the a. m. column. In addition, cam 75 engages pawl 74 to move the tape one step and raise abutment 88 so that an inserted card will be positioned for the next day's line. At 1:59 the regular impulse circuit is broken and the stepping mechanism will be inoperative until the master clock sends an impulse through at 8 a. m. the next day when the sequence is repeated.

It will be noted that the recorder is thus provided with a source of periodic electrical impulses occurring once each minute (wires 110—109) and a source of timed electrical impulses occurring at certain preselected times only (wires 110—128) to which the magnet 27 is alternately connected by switching means operated by the magnet controlled ratchet 22 at certain points in its rotation to enable the described card records to be made.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a time recorder, a card receiver for receiving and guiding a record card, record printing means, an endless tape, means carried by said tape and extending into the path of the card as it is inserted into the receiver for locating said card in printing position, time controlled means for periodically advancing said tape and thereby said locating means so as to vary the depth to which the card may be inserted in accordance with predetermined time periods, a resilient support for said tape normally biased to a home position, said support being movable from said home position by said tape upon application of pressure through the card on said locating means, and means operable by said support during such movement to effect operation of said printing means.

2. A time recorder including, in combination, a guideway for insertably receiving a record card, an endless tape, supporting wheels for supporting said tape so that the surfaces thereof are parallel to the guideway, time controlled means for advancing said tape at the end of predetermined time periods, an abutment carried by the tape and extending outwardly from and substantially perpendicular to the surface of the tape adjacent the guideway so as to protrude within said guideway to engage said card and limit the depth of insertion thereof in accordance with the time period during which the card is inserted, one of

said wheels being resiliently mounted and so positioned that inward pressure on the card will act through the abutment and tape to move said one wheel, record printing means, and means operable by said wheel during its movement to cause said printing means to make a printed record on said card.

3. In a time recorder for printing a record on a card, printing means, electrical means for operating said printing means, an energizing circuit for said electrical means, a guideway for receiving said card, an endless tape, supporting wheels for supporting said tape so that its surfaces are substantially parallel to said guideway, one or more of said wheels having a driving connection with the tape, time controlled means for rotating those wheels with such driving connections, an abutment extending substantially perpendicular to the plane of the guideway and carried by said tape for engaging the card to locate it in printing position in said guideway according to the time period in which said card is inserted, a resilient mounting for another of said wheels positioned relative to said driving wheels and said guideway so that inward pressure on said card will act through the abutment and tape to move said resilient mounting, and a switch operable by such movement of said mounting to complete said energizing circuit.

4. In a card time recorder, in combination, a card holder, an endless tape carrying a projection thereon extending substantially perpendicular therefrom to a point within said card holder to form an abutment for a record card inserted in said holder, a plurality of supports for said tape, time controlled means for advancing the tape over the supports in one direction at predetermined intervals to change the position of the abutment with respect to the holder so as to vary the depth to which the card may be inserted, means for preventing reverse movement of said tape, a resilient mounting for one of said supports normally biased to keep the tape taut but movable in a predetermined path in response to slight pressure exerted through the inserted card on the abutment in such a direction as to cause a slack in the tape during the continuance of said pressure, record printing means for printing a time record on said card in a predetermined location depending on the position of the abutment, and means actuated by the movable support for rendering said printing means effective.

5. In a card time recorder, in combination, a card holder, an endless tape carrying a projection thereon extending substantially perpendicular from the surface to a point within said card holder to form an abutment for a record card inserted in said holder a plurality of rotatable guides for supporting said tape, time controlled means for advancing said tape over said rotatable guides in one direction at predetermined intervals to change the position of the abutment with respect to the holder so as to vary the depth to which the card may be inserted, means for preventing movement of the tape in the reverse direction, a rockable bell crank member forming a mounting for one of said guides, a spring for normally biasing said member to a home position to maintain the tape taut, the application of pressure through the card on the abutment overcoming the bias of the spring to rock the bell crank member out of said home position to cause a slack in the tape during the continuance of such pressure, record printing means for printing a time record on said card in predetermined location depending on the position of the abutment, and a switch actuated by the bell crank member in the course of its movement for rendering the printing means effective.

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