Feb. 26, 1946. A. J. FINDLAY 2,395,781

ELECTRIC TIME RECORDER

Filed March 6, 1943 4 Sheets-Sheet 1

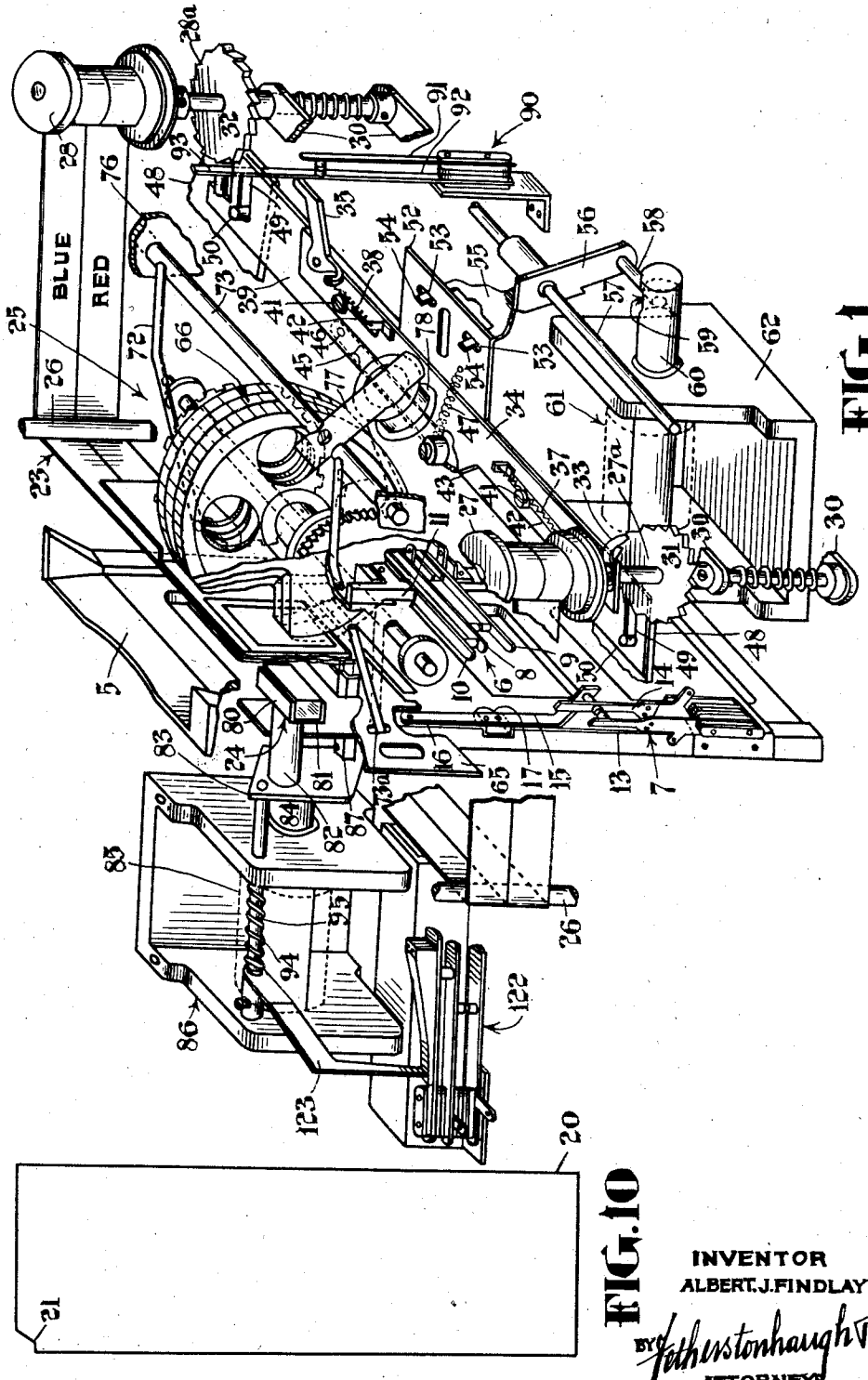


FIG. 1

FIG. 10

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ELECTRIC TIME RECORDER

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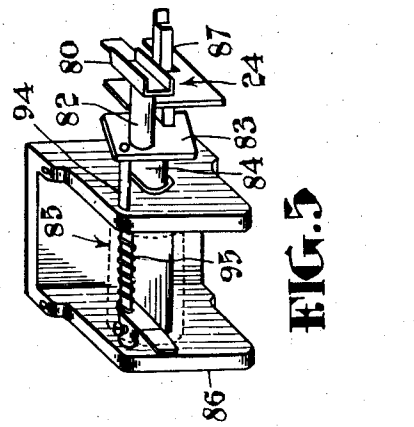


FIG.5

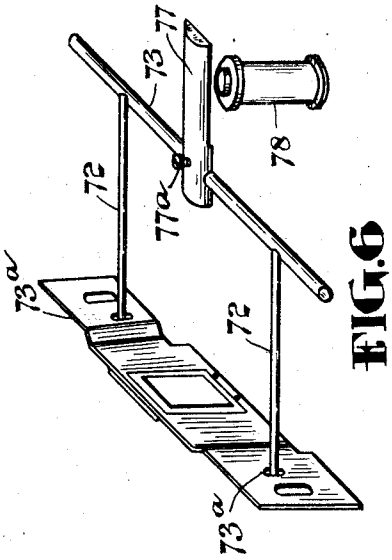


FIG.6

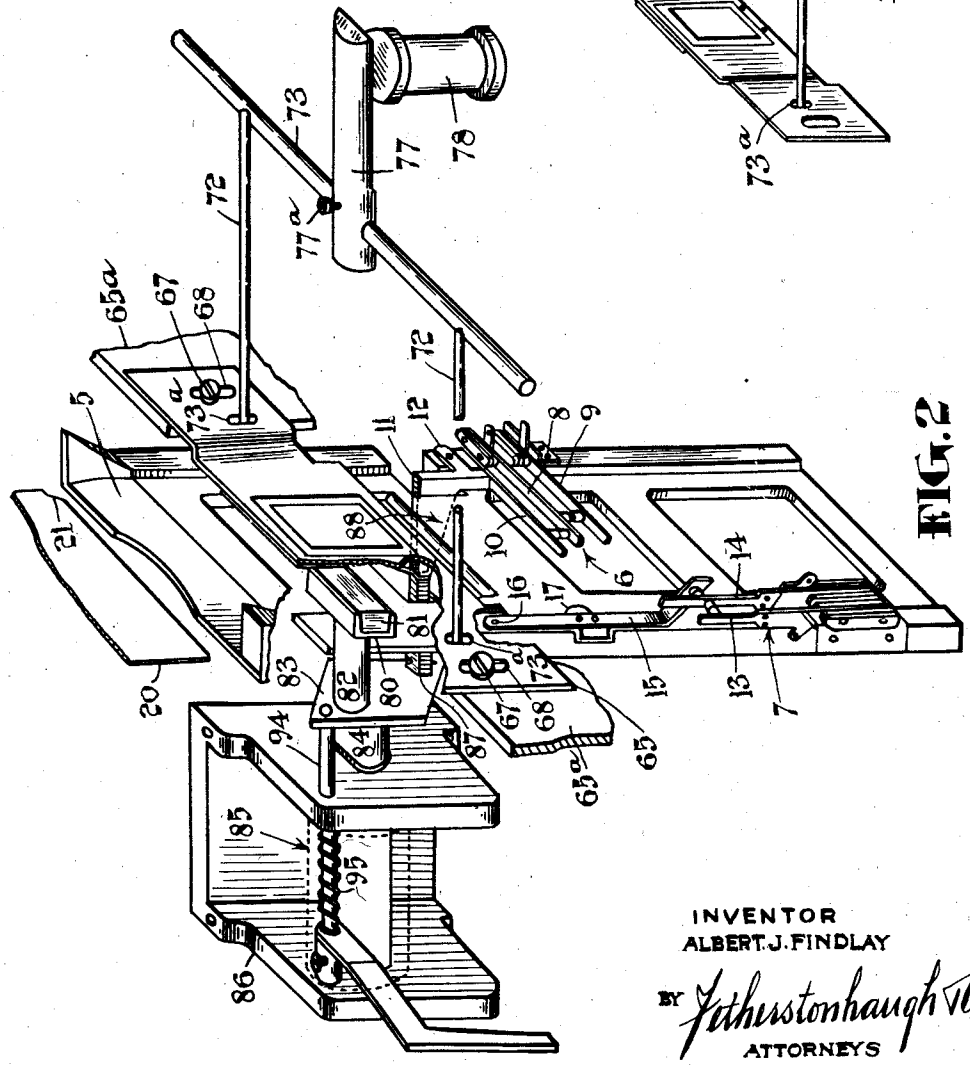


FIG.2

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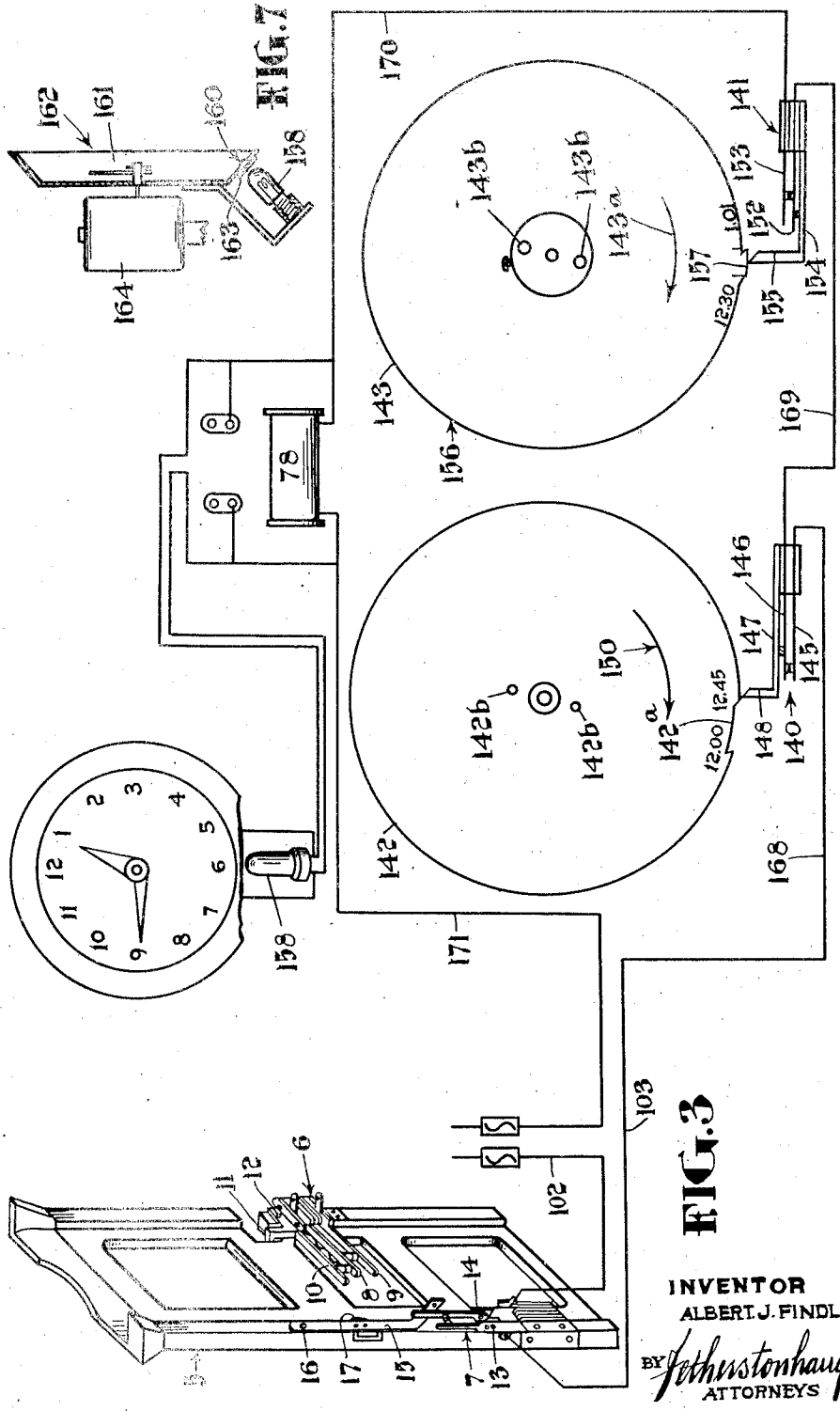


FIG. 3

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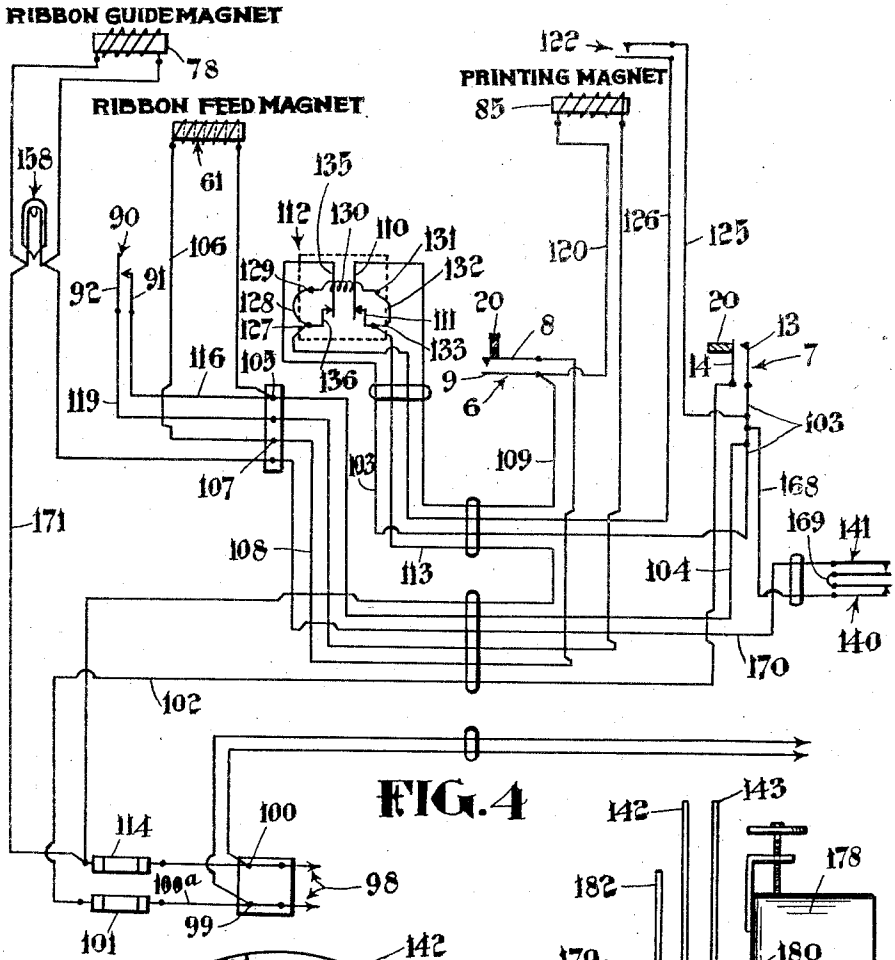


FIG. 4

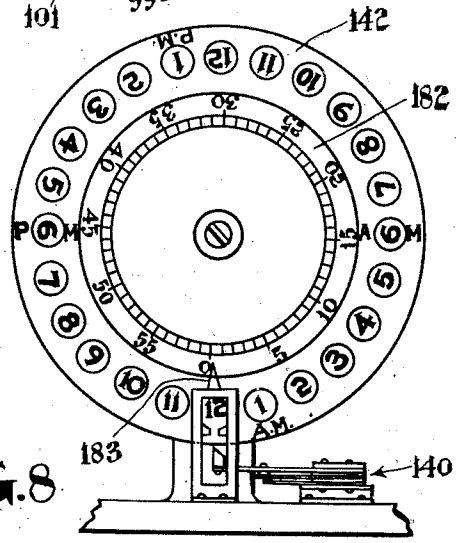


FIG. 8

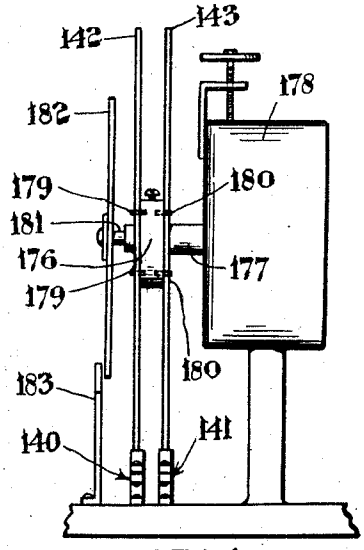


FIG. 9

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Patented Feb. 26, 1946

2,395,781

UNITED STATES PATENT OFFICE

2,395,781

ELECTRIC TIME RECORDER

Albert J. Findlay, Montreal, Quebec, Canada, assignor to John B. Frosst and Eliot S. Frosst, both of Montreal, Quebec, Canada

Application March 6, 1943, Serial No. 478,304
In Canada December 5, 1942

5 Claims. (Cl. 101—336)

This invention relates to improvements in electric time recorders of the card actuated type.

Conventional electric time recorders of the card actuated type are designed so that the insertion of a workman's time card in a suitable receiver provided for this purpose establishes electrical connections resulting in the energization of a single, large, heavy-duty electro-magnet which furnishes all the power for operating the ribbon feed mechanism, the ribbon feed reversing mechanism, the printing hammer operating mechanism, the card receiver operating mechanism which functions to shift the card receiver from the "in" to the "out" position, and, in the case of a recorder equipped with a two-color ribbon, the mechanism whereby differently colored portions of the ribbon are selectively positioned in line with the printing hammer according to whether the workman's card is inserted in the receiver during "working hours" or "non-working hours." The operation of all these mechanisms by a single magnet not only makes it necessary to use a large, heavy-duty magnet but also requires an elaborate and complicated arrangement of mechanical parts which adds greatly to the cost of building the recorder and maintaining it in good working order. Moreover, since the mechanisms referred to operate simultaneously at certain times and in delayed sequence at other times, the magnet used must necessarily be a heavy-duty magnet and must be supplied with sufficient current to take care of the "peak" load conditions which obtain when said magnet is called upon to operate several of said mechanisms simultaneously. This means that, most of the time, the current supplied to the magnet is greatly in excess of actual requirements.

With the foregoing in mind one object of the present invention is to provide a generally improved time recorder of the card actuated type in which the component parts of each of the mechanisms previously referred to are simplified and reduced in number in such manner that such mechanisms are rendered more compact and less expensive to build and maintain in good working order.

Another object is to provide a generally improved electric time recorder of the card actuated type in which relatively small separate electromagnets are provided for operating (*a*) the ribbon feed mechanism and the ribbon reversing mechanism; (*b*) the printing hammer; and (*c*) the ribbon guide mechanism whereby differently colored portions of the ribbon are selectively positioned in line with the printing hammer according to the time at which the card is inserted in the card receiver. These magnets take only a small amount of current and are connected in circuit with suitable control switches including card actuated switches arranged in the card receiver so that they are energized only when required.

Another object of the invention is to provide means whereby the dial of the time clock associated with the recorder is illuminated whenever the workman's card is inserted in the card receiver during "working hours" thus calling the workman's attention to the fact that he is going in or out at an irregular or working hour.

Another object of the invention is to provide means whereby the insertion of the workman's card in the receiver during working hours actuates audible signalling means warning both the workman and the timekeeper that the workman is registering in or our during "working hours."

A further object is to provide means whereby visible signalling means located remote from the time recorder may be operated when the workman's card is inserted in the receiver during "working hours" so as to apprise the time-keeper or employer of this fact.

Another object is to provide means whereby the recorder is prevented from functioning when the workman's card is inserted in the card receiver with the wrong side of the card facing the printing wheels against which the card is pressed during the card printing operation.

Other objects, advantages, and characteristic features of the invention will be more readily understood from the following detailed description taken in connection with the accompanying drawings, in which—

Fig. 1 is a perspective view showing, more or less diagrammatically, the relative arrangement of the component parts of the improved time recorder provided in accordance with my invention.

Fig. 2 is a view similar to Fig. 1 but with the printing wheels and the ribbon feed mechanism omitted in order to show more clearly the arrangement of the receiver switches and the means provided for operating the ribbon guide.

Fig. 3 is a view illustrating the manner in which the ribbon guide magnet and the control switches associated with said magnet are connected in circuit with one of the receiver switches. This view also illustrates the manner in which the clock illuminating lamp is connected in parallel with the ribbon guide magnet.

Fig. 4 is a wiring diagram showing the manner in which the various magnets and contact switches provided in accordance with the inven-

tion are connected in circuit with a source of current.

Fig. 5 is a perspective view of the printing hammer and card cutting knife assembly per se.

Fig. 6 is a perspective view of the ribbon guide and its electric magnet operating means.

Fig. 7 is a sectional view of the time clock showing the dial illuminating lamp associated therewith.

Fig. 8 is a front view of the disc assembly which controls the opening and closing of the ribbon guide control switches.

Fig. 9 is a side view of the assembly shown in Fig. 8, and

Fig. 10 is a view showing the type of workman's card which is inserted in the card receiver to close the card actuated switches located therein.

Referring more particularly to the drawings, 5 designates a conventional card receiver equipped with normally open card actuated control switches 6 and 7 arranged at opposite sides thereof. Switch 6 comprises normally separated spring contacts 8 and 9, a switch closing spring 10 and a pivotally mounted card actuated abutment member 11, the latter being pivoted to the card receiver at 12 and being normally held in its uppermost position by the underlying spring 10. Switch 7 comprises normally separated spring contacts 13 and 14 and a switch closing lever 15, the latter being pivoted at its upper end as indicated at 16 and having its lower end arranged to force the contact 14 into engagement with the contact 13 when said lever is swung outwardly in the direction of switch 7. Intermediate its upper and lower ends lever 15 is provided with a projection 17 adapted to be engaged and forced outwardly by the side edge of a card inserted in the receiver 5.

The preferred type of card provided for insertion in receiver 5 is indicated at 20 in Fig. 10. This card, which is adapted to receive the printed time impressions, is ruled off and printed in any conventional or desired manner and is provided with a notch 21 at one of its upper corners. It is inserted in receiver 5 in an inverted position so that abutment member 11 is received in notch 21 and is forced downwardly by the upper edge of said notch to depress spring 10 and thereby close the normally separated contacts 8 and 9 of switch 6. Just before switch 6 is thus closed the side edge of the card remote from notch 21 engages projection 17 of lever 15 and causes said lever to be swung outwardly thereby forcing spring contact 14 into engagement with contact 13 to close switch 7.

If the inverted card is accidentally inserted in the receiver 5 so that the un-cut lower corner of the inverted card is positioned to engage and depress the abutment 11 the switch 6 will close but switch 7 will remain open since when the card has been forced down to its lowermost position the projection 17 of lever 15 will be accommodated in the notch 21 without causing the lever 15 to be swung outwardly to its switch closing position. It will thus be seen that the provision of the notch 21 ensures that the inverted card must be properly inserted in the receiver 5 to close both of the card actuated switches 6 and 7.

As shown more particularly in Fig. 1, the card receiver 5 is arranged so that the card inserted therein is interposed between the ribbon 23 and the printing hammer 24 of a card printing and cutting mechanism generally indicated at 25. The ribbon 23 is trained around guide posts 26 located at opposite sides of the card receiver 5 and has its ends wound on feed spools 27 and 28 which are fixed to rotate with the vertically extending spool driving shafts 27a and 28a. These shafts are journalled in suitable bearings 30 and are respectively equipped with ratchet wheels 31 and 32. A pawl 33 is pivotally mounted on a pawl carrying plate 34 adjacent one end of said plate and constitutes the driving pawl for the ratchet 31. A similar pawl 35 is pivotally mounted on plate 34 adjacent the opposite end thereof and constitutes the driving pawl for ratchet 32. The pawls 33 and 35 are normally held in the position shown in Fig. 1 by biasing springs 37 and 38, these springs being connected between the pawls and the plate 34 as shown in the drawings, or in any other suitable manner. The pawl carrying plate 34 is mounted on a supporting plate 39 so that it is capable of longitudinal movement with respect to said supporting plate. In this connection it will be noted that pawl carrying plate 34 is slidably secured to its supporting plate 39 by screws 41 working in elongated guide slots 42. When the pawl carrying plate 34 is positioned as shown in Fig. 1 the pawl 33 is disposed in driving engagement with the ratchet wheel 31 of the spool driving shaft 27a and the pawl 35 is disposed out of driving engagement with the ratchet wheel 32 of the spool driving shaft 28a. The pawl plate 34 is yieldingly held in the position shown in Fig. 1 by the plate projection 43 and the engaging roller 44, the latter being carried by the free end of an arm 45 having its opposite end pivoted, as at 46, to the supporting plate 39. The free or roller carrying end of arm 45 is secured to plate 39 by a spring 47 which normally serves to hold the roller 44 in the position shown in Fig. 1.

The plate 39 is mounted on suitable supports 48 so that said plate is capable of bodily movement in the direction of its width. In this connection it will be noted that plate 39 is provided with transversely extending slots 49 to receive guide projections 50 which extend upwardly from the supports 48 and serve to guide plate 39 in its lateral movement.

Plate 39 is provided with an extension 52 located substantially midway between the ends of said plate. This extension 52 is provided with slots 53 in which are fitted the arms 54 of a fork 55 provided at the upper end of a lever 56 which is intermediately pivoted to swing about a pivot shaft 57. The lower end of lever 56 is provided with a laterally extending pin 58 which is fitted in a slot 59 provided in the armature 60 of an electro-magnet 61 which is mounted in a suitable frame 62, said lever 56 and armature 60 being positioned as shown in Fig. 1 when the magnet 61 is in its normal or deenergized condition.

As hereinafter described, the closure of switches 6 and 7 by insertion of a card 20 in receiver 5 establishes circuit connections whereby the ribbon feed magnet 61 is energized to move the armature 60 to the left. The resulting swinging movement of lever 56 causes the supporting plate 39 and its associated pawl carrying plate 34 to be moved to the right as a unit, thus causing the pawl 33 engaging the ratchet wheel 31 to effect a partial revolution of the ribbon spool 27 whereby a predetermined portion of the ribbon is wound on the spool 27 and a corresponding portion is unwound from the spool 28. This feeding of the ribbon from spool 28 to spool 27 occurs each time a card is inserted in the receiver 5 to close the switches 6 and 7 until all the ribbon has been unwound from the spool 28 with the exception of the end of the ribbon which is anchored to

said spool. When this condition obtains the tensioning of the ribbon between spools 27 and 28 prevents further turning of spool 27. Consequently, during the next movement of the plates 39 and 34 in a ribbon feeding direction the pawl 33 fulcrums on the stationary ratchet 31 and causes the pawl carrying plate 34 to be shifted in the direction of the spool 28 until the pawl 35 is engaged with the ratchet 32 and the pawl 33 disengaged with the ratchet 31. As the pawl carrying plate 34 is thus moved in the direction of the spool 28 the roller 44 is forced out of the way of the leading sloping edge of the plate projection 43 and then springs back to engage the trailing sloping edge of said projection to assist in completing the movement of the plate 34 necessary to engage the pawl 35 with the ratchet 32. When the plate 34 has thus been shifted to engage the pawl 35 with the ratchet 32 subsequent operations of the plates 39 and 34 by the ribbon feed magnet 61 cause the ribbon to be fed from the spool 27 to the spool 28 until all the ribbon has been wound on the spool 28 with the exception of the end of the ribbon which is anchored to the spool 27. When this last named condition occurs the pawl 35 fulcrums on the stationary ratchet 32 and causes the pawl carrying plate 34 to be shifted back to the position shown in Fig. 1.

That portion of the ribbon which travels between the guide posts 26 is threaded through a vertically movable ribbon guide 65 which lies between the type wheels 66 and the adjacent side of the card receiver 5. The type wheels 66 are mounted and operated in accordance with conventional procedure and form no part of the present invention. The ribbon guide 65 is fastened to portions 65*a* of the frame structure (see Fig. 2) by guide screws 67 working in guide slots 68 which permit the ribbon guide to be raised and lowered as hereinafter described. In this connection it will be noted that ribbon 23 is a two-color ribbon, the upper half being blue and the lower half being red. The ribbon guide is normally positioned so that the upper or blue half of the ribbon is in line with the printing hammer 24. If, with the ribbon in this position, the card is inserted in the receiver between certain non-working hours, say, from 12:00 to 1:00 o'clock, the time indication made on the card will be made in blue. If, however, a card is inserted in the receiver during the working hours of the employee suitable circuit connections are established for operating electro-magnetic means whereby, prior to the printing operation, the ribbon guide 65 is raised to position the red portion of the ribbon in line with the printing hammer 24, thus causing the time impression to be printed on the card in red, indicating that the impression was made during the employer's time. In the present instance the electro-magnetic operating means provided for thus raising the ribbon guide 65 to the "red" printing position comprises a pair of lifting arms 72 extending laterally from a rock shaft 73 and having their free ends fitted in the ribbon guide slots 73*a*. The rock shaft 73 is mounted in suitable bearings 76 (Fig. 1) and carries an armature 77 which projects laterally therefrom in a direction opposite the direction of the arms 72. The armature 77 is fastened to the rock shaft 73 by a screw 77*a* which permits the armature to be turned about said shaft to vary the clearance between the free ends of the armature and its operating magnet which is indicated at 78. When the magnet 78 is energized by the insertion of a card in the receiver 5 during the employee's working hours it attracts the armature 77 and rocks the shaft 73 to raise the ribbon guide 65 so that the red portion of the ribbon is positioned in line with the printing hammer 24 just prior to the printing operation.

The printing hammer 24 comprises a channel member 80 in which a rubber block 81 is fitted. The channel 80 is fastened by a neck member 82 to a pressure plate 83 which, in turn, is carried by the armature 84 of an electro-magnet 85 mounted in a suitable frame 86. The plate 83 also carries a channel-shaped card cutting knife 87 which is arranged to slide over the extension 88 of the previously mentioned switch closing card actuated abutment 11. The magnet 85 is energized by the closure of a normally open switch 90 which is operated to a closed circuit position by the plate 39 of the ribbon feed mechanism each time such plate is operated to effect a feeding movement of the ribbon 23. In this connection it will be noted that switch 90 comprises normally separated contacts 91 and 92, the latter being positioned to be engaged by a switch closing insulating bushing 93 carried by one end of the ribbon feed plate 39.

When the printing hammer magnet 85 is energized by closure of switch 90 the armature 84 thereof is moved to the right so that the rubber block 81 is engaged with the card inserted in the card receiver 5 and causes the ruled face of the card and the card engaging portion of the ribbon 23 to be pressed against the type wheels 66 so that a time impression is printed on said card. At the same time the knife 87 is moved inwardly over the card actuated abutment member 11 and clips off a portion of the card so that the notch 21 is thereby deepened in the vertical direction of the card. This deepening of the notch 21 permits the card, during a subsequent insertion thereof, to be moved further downwardly in the card receiver 5 before the upper edge of the notch engages the abutment 11 to close the switch 6 and thus ensures that the time impression printed on the card at each insertion thereof will be at a higher level with respect to the previously printed time impression. When the magnet 85 is deenergized upon completion of each printing operation the printing hammer 24 and the cutting knife 87 are returned to their starting position by means of a spring 94 encircling a guide rod 95 which is slidably mounted in the magnet frame 86 and is attached to the pressure plate 83.

From the foregoing it will be seen that when a card 20 is properly inserted in the card receiver 5 the following operations take place. The switches 6 and 7 are both closed and establish circuit connections resulting in the ribbon feed magnet 61 being energized to operate the ribbon feed mechanism previously described so that a fresh portion of the ribbon is fed to a position opposite the printing hammer 24. During the operation of the ribbon feed mechanism the movement of the ribbon feed plate 39 closes the switch 90 and establishes further electrical connections whereby the printing magnet 85 is energized to operate the printing hammer 24 and the card cutting knife 87.

These features of my invention will be more readily understood from the following description of the various circuits shown in Fig. 4.

Circuit "A" (ribbon feed magnet circuit)

This circuit is energized by a 110 volt alternating current source 98 connected to the power terminals 99 and 100 and is completed when

switches 6 and 7 are closed by the insertion of a card 20 in the card receiver 5. In the closed condition of this circuit current flows through conductor 100a fuse block 101, conductor 102, switch 7, conductors 103 and 104, terminal 105, ribbon feed magnet 61, conductor 106, terminal 107, conductor 108, switch 6, conductor 109, contacts 110 and 111 of relay 112, conductor 113 and fuse block 114 to power terminal 100, thus completing the circuit connections necessary for energizing the ribbon feed magnet 61.

Circuit "B" (printing magnet circuit)

This circuit is completed when switch 90 is closed by the feed plate 39 of the ribbon feed mechanism which is actuated by the ribbon feed magnet 61. In the completed condition of circuit "B" current flows from power terminal 99 through conductor 100a, fuse block 101, conductor 102, switch 7, conductors 103 and 104, terminal 105, conductor 116, switch 90, conductor 119, printing magnet 85, conductors 120 and 109, relay contacts 110 and 111, conductor 113 and fuse block 114 to power terminal 100, thus completing the circuit connections necessary to energize printing magnet 35 to effect operation of the printing hammer 24 and card cutting knife 87.

Circuit "C" (relay operating circuit)

This circuit is completed when a normally open switch 122 (Figs. 1 and 4) is closed by an arm 123 fixed to the guide rod 94 associated with the printing hammer 24 and the card cutting knife 87. The switch 122 and its operating arm 123 are arranged so that switch 122 is automatically closed each time the hammer 24 and the knife 87 are operated by the printing magnet 85. In the completed condition of circuit "C" current flows from terminal block 99 through conductor 100a, fuse block 101, conductor 102, switch 7, conductors 103 and 125, switch 122, conductor 126, relay terminal 127, relay strap 128, relay terminal 129, relay operating coil 130, relay terminal 131, relay strap 132, relay terminal 133, conductor 113, and fuse block 114 to power terminal 100. The completion of this circuit energizes the operating coil 130 of relay 112 so that the normally closed relay contacts 110 and 111 are opened and the normally opened relay contacts 135 and 136 are closed.

Circuit "D" (relay controlled locking circuit)

As will be readily understood from a study of the circuit connections involved in completing circuit "C" the opening of the relay contacts 110 and 111 serves to open circuit the previously established circuits "A" and "B" and to establish what may be termed a locking and holding circuit which prevents a second operation of the ribbon feed magnet 61 and the printing magnet 85 until the inserted card 20 has been removed from the receiver 5 to permit reopening of the card receiver switches 6 and 7. It will be noted that when the relay contacts 110 and 111 are opened and the relay contacts 135 and 136 are closed by the aforesaid energization of the relay operating coil 30, the current flows in the holding or locking circuit as follows: From the power terminal 99 through conductor 100a fuse block 101, conductor 102, switch 7, conductor 103, relay contacts 135 and 136, relay terminal 127, relay strap 128, relay terminals 129, relay operating coil 130, relay terminal 131, relay strap 132, relay terminal 133, conductor 113 and fuse block 114 to power terminal 100.

When the card 20 is removed from the receiver 5 the re-opening of switch 7 deenergizes relay coil 130 and thus breaks the holding or locking circuit so that normal circuit conditions are restored.

The energization of the ribbon guide operating magnet 78 (Figs. 3 and 4) is controlled by switches 140 and 141 and their associated timing discs 142 and 143. Switch 140 comprises switch contacts 145 and 146 and a switch closing member 147 equipped with a projection 148 arranged to ride the peripheral edge of disc 142. A recess 142a of predetermined length is cut in the periphery of disc 142 and is adapted to receive the projection 148 of switch closing member 147 when disc 142 is rotated to a predetermined position. The spring contacts 145 and 146 of switch 140 are normally biased to a separated or switch opening position but are pressed together to close the switch as long as the extension 148 of the switch closing member 147 is riding the uncut portion of the peripheral edge of disc 142. In the present instance the recess 142a has been marked with legends indicating that it represents a time interval of from 12:00 to 12:45. The disc 142 rotates in the direction indicated by the applied arrow 150. When the uncut peripheral edge portion of the disc located at the leading end of the recess 142a passes over and beyond the extension 148 of the switch closing member 147 the switch contacts 145 and 146 separate since the said extension 148 of the switch closing member 147 is then forced into the recess 142a. In the present instance recess 142a is designed so that the extension 148 of switch closing member 147 will enter this recess at 12:00 and at 12:45 will be forced out of the recess sufficiently to reclose the switch 140.

Switch 141 comprises spring contacts 152 and 153 which are pressed together by the switch operating member 154 when the extension 155 of said switch operating member is riding the peripheral edge portion 156 of the disc 143. Disc 143 rotates in the direction indicated by the arrow 143a and is provided with a projection 157 which, as indicated by the associated legends, is made of predetermined length so as to represent a time interval of from 12:30 to 1:01. It will thus be seen that at 12:30 the projection 157 of disc 143 engages and depresses the extension 155 of the switch closing member 154 and thus permits the spring contacts 152 and 153 to spring back to open switch 141. The projection 145 passes out of contact with the extension 157 and permits the said closing member 154 to return to its switch closing position.

The switch 7, ribbon guide operating magnet 78 and the switches 140 and 141 are connected in series with each other and in parallel with a signal lamp 158.

In practice the number of recesses 142a provided in disc 142 and the number of projections 143a provided on disc 143 will depend upon a pre-selected time schedule. In the present instance, for simplicity of description, it is assumed that disc 142 is provided with a single recess 142a and that disc 143 is provided with a single projection 143a. With this explanation it will be understood that switch 140 is closed except between 12:00 and 12:45 and that switch 141 is closed except between 12:30 and 1:01. With both switches 140 and 141 closed as they would be during the employer's time, it will be apparent that the closure of switch 7 by the insertion of a card

20 in the receiver 5 will complete the circuit connections necessary to energize the ribbon guide operating magnet 78 and the signal lamp 158. The energization of the magnet 78 causes the ribbon guide 65 to be raised as previously described so that the red portion of the ribbon is elevated into alignment with the printing hammer 24 so that the time impression will be printed on the inserted card in red, thus indicating that the card was inserted in the receiver during the employer's time. The lamp 158 serves as a telltale which also warns the employee that he has inserted his card in the receiver during the employer's time. In this connection it will be noted that lamp 158 is arranged opposite an elongated aperture 160 provided in the dial 161 of the clock generally indicated at 162. The slot 160 is preferably covered by red transparent material 163 so that the red light shows through this material and illuminates the hour and minute hands of the clock so that the employee's attention is definitely directed to the fact that he is registering during his employer's time. The hour and minute hands of the clock 162 are operated by an electric clock motor 164 according to the conventional practice followed in connection with the operation of time recorder clocks.

Due to the alternating nature of the current supplied to the magnet 78 the rapid attraction and release of the armature 77 of said magnet also sets up a buzzer effect which serves as a visible warning that the employee is registering during his employer's time. The terminals 165 and 166 (Fig. 3) are provided so that remote audible and/or visible signal means located in a timekeeper's office may be connected to operate simultaneously with the signal lamp 158 and the buzzer afforded by the magnet 78 and its armature 77.

At 12:00 the disc 142 is rotated to a position such that the extension 148 of switch closing member 147 enters the recess 142*a*, thus permitting switch 140 to open and to break the previously described circuit provided for energizing the magnet 78 and the lamp 158. Consequently, if a card is inserted in the receiver 5 at 12:00 it will be printed in blue since the magnet 78 remains deenergized and the ribbon guide 65 consequently remains in its lower position so that the blue portion of the ribbon is in line with the printing hammer 24. At 12:30 the switch 141 is also opened by reason of the fact that the projection 157 is engaging and depressing the extension 155 of the switch operating member 154. At 12:45 switch 140 is reclosed as previously explained so that when switch 141 is subsequently closed at 1:01, the circuit for energizing the magnet 78 will be completed by closure of switch 7 if a card is inserted in the receiver 5 at 1:01.

The manner in which the switches 140 and 141 are connected in circuit with the switch 7, magnet 78 and lamp 158 is clearly shown in Figs. 3 and 4 but may be briefly noted as follows: In the closed condition of switches 7, 140 and 141, the current supplied from the 110 A. C. voltage source 98 flows through conductor 102, switch 7, conductors 103 and 168, switch 140, conductor 169, switch 141, conductor 170, magnet 78, and conductor 171 to fuse block 114. The lamp 158, being connected across conductors 170 and 171 as clearly shown in the drawings, is energized simultaneously with the ribbon guide operating magnet 78.

As shown in Figs. 8 and 9, the hour discs 142 and 143, which time the closing of the previously described ribbon guide magnet circuit, are fixed to rotate with a collar 176 which is mounted on and driven by the hour shaft 177 of an electric clock motor 178. The disc 142 (Fig. 3) is provided with positioning holes 142*b* to receive driving pins 179 carried by the collar 176. Disc 143 is provided with similar positioning holes 143*b* to receive driving pins 180 carried by the collar 176. The discs 142 and 143 are thus removably mounted on the collar 176 so that they may be easily removed and replaced by other discs having the peripheral edges thereof shaped to provide a different angular arrangement of switch operating recesses and projections for controlling the opening and closing of the switches 140 and 141 according to a pre-selected time schedule.

The discs 142 and 143 are also centrally apertured to receive therethrough the hour hand shaft 177 which is a hollow shaft enclosing a minute shaft 181 which carries a disc 182 which is graduated in terms of minutes as compared with the hour disc 142 which is graduated in terms of hours. A suitable pointer 183 is arranged in operative relation to the minute disc 182.

The hour and minute shafts 177 and 181 of the disc driving clock motor 178 are preferably driven to operate in synchronism with the hour and minute hand shafts of the main clock motor 164. However, it will be understood that the use of synchronous motors for operating the clock 162 and the hour disc 142 and 143 is not an essential feature since the hour shaft 177 and the minute shaft 181 shown in Figs. 8 and 9 may be operated mechanically from the hour and minute shafts of the clock 164.

Having thus described my invention, what I claim is:

1. An electric card-printing time recorder of the card actuated type comprising card-printing mechanism including type-carrying means, a movable printing hammer, biasing means normally holding said printing hammer in a retracted position opposite said type-carrying means, a ribbon feed mechanism for feeding successive portions of a printing ribbon to a printing position between the type-carrying means and the printing hammer, normally open card-actuated switch means arranged to be engaged and closed by a card when the latter is inserted in an impression-receiving position between the retracted printing hammer and the printing ribbon, an electro magnet for operating said ribbon feed mechanism, said magnet being connected to a source of current through said normally open card-actuated switch means so as to be energized only when said switch means is closed by said card, a second magnet for advancing the printing hammer, against the resistance of its biasing means, to a printing position in which it bears against the card interposed therebetween and the printing ribbon and serves to press the card and printing ribbon against the type-carrying means, said second magnet being connected to a source of current through said card-actuated switch means and through a normally open printing hammer control switch and being energized only when both the card-actuated switch and the printing hammer control switch are closed, said ribbon feed mechanism including an element arranged to engage and close said printing hammer control switch immediately following a shifting of the printing ribbon by said ribbon feed mechanism.

2. An electric time recorder as set forth in claim 1, including relay-controlled means for pre-

venting a second operation of the card-printing mechanism until after the card closing the card-actuated switch means has been withdrawn to permit re-opening of said card-actuated switch means, said relay-controlled means comprising a pair of normally closed relay contacts, a pair of normally open relay contacts, a normally deenergized relay operating coil adapted, when energized, to open said normally closed relay contacts and to close said normally open relay contacts, a normally open relay operating switch connected in series with the relay operating coil, the card-actuated switch means and a source of current so that said coil is initially energized when both the relay operating switch and the card-actuated switch means are in closed circuit condition, said normally closed relay contacts being connected in series with the card-actuated switch means and the operating magnets of the ribbon feed mechanism and the printing hammer so that the separation of said normally closed relay contacts serves to open circuit said magnets and to maintain the open circuit condition of the magnets until said relay contacts are permitted to reclose by deenergization of said coil, said normally open relay contacts being connected to a source of current in series with said card-actuated switch means and said coil and serving, when closed by said coil, to maintain a closed circuit for said coil until the card is withdrawn to permit deenergization of the coil by the re-opening of the card-actuated switch contacts, and an element carried by the printing hammer adapted to close the relay operating switch during movement of the printing hammer to its printing position and to permit re-opening of the relay operating switch during return movement of the printing hammer to retracted position under the influence of the printing hammer biasing means.

3. An electric time recorder as set forth in claim 1 including lock-out means for preventing a second operation of the carding-printing mechanism until after the card closing the card-actuated switch means has been withdrawn to permit reopening of said card-actuated switch means, said lock-out means including a normally open lock-out switch, a switch operating element carried by said printing hammer adapted to engage and close said lock-out switch during movement of the printing hammer to its printing position and to permit reopening of the lock-out switch during return movement of the printing hammer to retracted position under the influence of the printing hammer biasing means, and circuit controlling devices operating, in response to closure of said lock-out switch, to open the energizing circuits of the ribbon feed magnet and the printing hammer magnet and to maintain the open-circuit condition of said magnets while the card-actuated switch means is held closed by said card, said circuit controlling devices being operable to re-establish normal circuit conditions in response to reopening of said card-actuated switch means.

4. An electric card-printing time recorder comprising a card receiver, a card-printing mechanism including electrically actuated printing elements and a pair of normally open card-actuated operating switches through which said printing elements are connected to a source of current so that both switches must be closed to effectively operate the printing mechanism, a pair of card-engaging switch closing members arranged in said receiver so that both members are operated to close said switches when a card, having a corner portion cut away to provide a notch, is correctly inserted in the receiver with the notched end down and the notch positioned adjacent a predetermined side of the receiver, one of said switch-actuating members being mounted for limited vertical movement from an elevated inoperative position to a lower switch closing position and being located so that it is engaged and depressed by the upper wall of said notch when the card is correctly inserted in the receiver, the other switch closing member being mounted for horizontal movement from an inoperative position to a switch closing position and being located so that it is engaged and operated to its switch closing position by the side edge portion of the card remote from the notch when the card is correctly inserted in the receiver, said last mentioned switch operating member being arranged so that it is accommodated in said notch without operating its associated switch when the card is incorrectly inserted in the receiver with the notched end down but with the notch disposed adjacent the wrong side of the receiver.

5. An electric card-printing time recorder as set forth in claim 4, in which one of the printing elements comprises a card-engaging printing hammer movable across the card receiver during the card-printing operation and a card cutter movable across the receiver with said printing hammer and adapted to clip off a portion of the card so that said notch is thereby deepened in the vertical direction of the card to permit the card, during a subsequent insertion thereof, to be moved further downwardly in the card receiver before the upper edge of the notch engages the underlying switch actuating member.

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