

Feb. 24, 1970

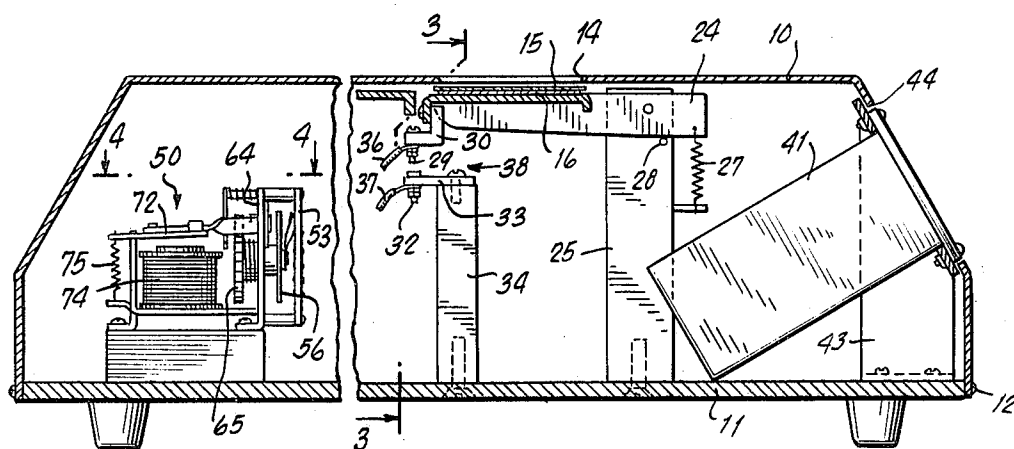
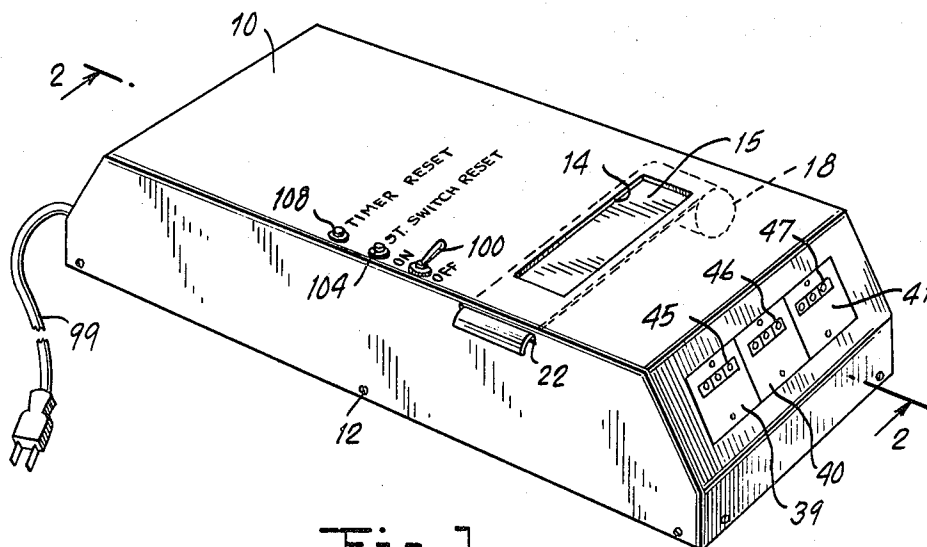
R. D. PETERS

3,496,779

SIGNATURE-IDENTIFYING APPARATUS

Filed March 7, 1968

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

Fig. 3.

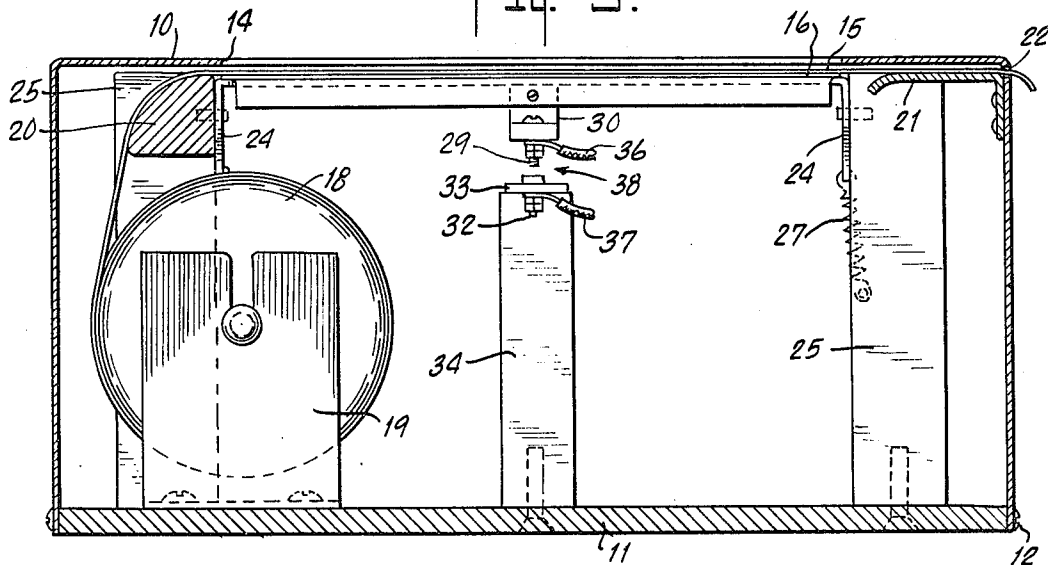


Fig. 4.

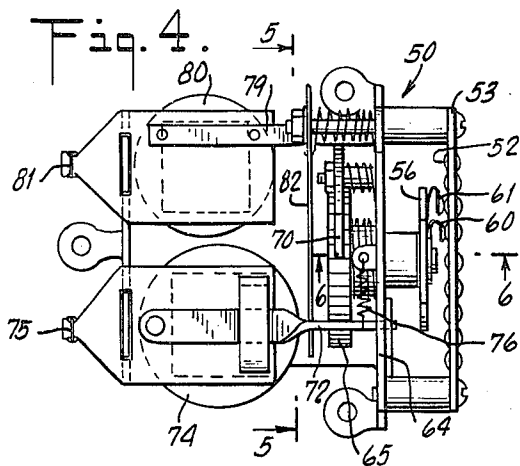


Fig. 6.

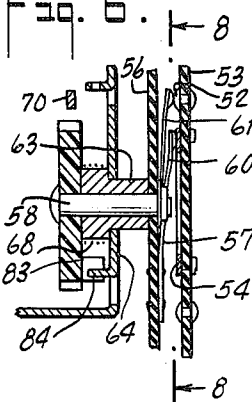


Fig. 8.

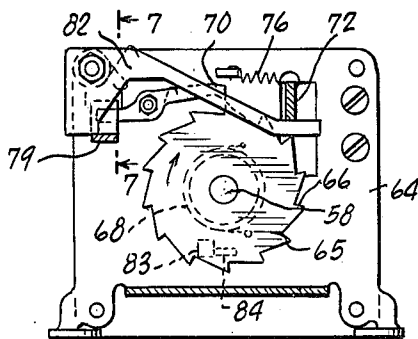
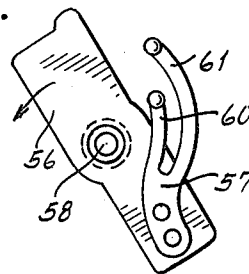


Fig. 5.

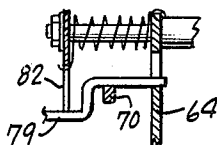


Fig. 7.

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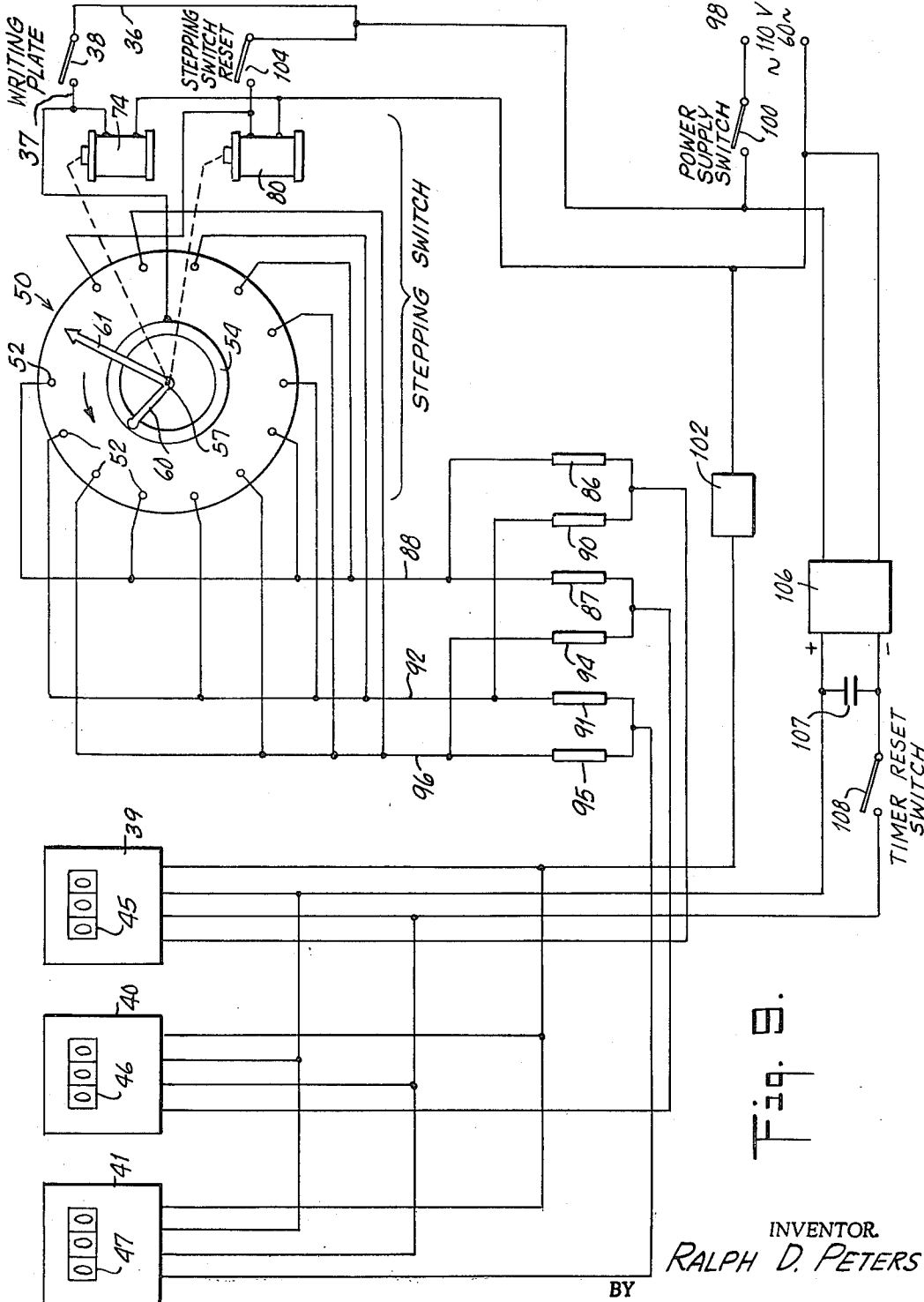
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3 Sheets-Sheet 3



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SIGNATURE-IDENTIFYING APPARATUS

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10 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for ascertaining the authenticity of a signature by sensing the duration of each of the succession of intervals during which pressure is applied by a writing instrument on a writing surface in forming the signature, and converting the sensed duration of the sequence of pressure-applying intervals into a digital code determined both by the duration of the several pressure-applying intervals and by the order of these intervals in the sequence. The apparatus includes a plurality of electrical timing devices each arranged to measure and display, as a digital reading, the cumulative time in which it is energized. A depressible writing plate on which the signature is written closes an electrical circuit each time writing-instrument pressure is applied thereto, and re-opens the circuit each time the pressure is removed. A stepping switch sequentially connects the timing devices into the circuit in a predetermined order in response to and in correspondence with successive closures of the circuit by the writing plate. Each of the timing devices, when thus connected, becomes energized and remains energized until removal of pressure from the writing plate re-opens the circuit. In this way, measurement of the successive pressure-applying intervals is made by the timing devices but distributed among them in accordance with the predetermined sequence of connections effected by the stepping switch so that the final readings of the timing devices (which together constitute the digital code) are determined both by the duration of the pressure-applying intervals and by their order in the sequence of intervals.

BACKGROUND OF THE INVENTION

This invention relates to apparatus for ascertaining the authenticity of a signature or like writing, i.e. for verifying the identity of the person inscribing the same.

In present-day practice, verification of signatures is generally effected by visual comparison of the signature to be verified with a previously written signature known to be authentic. Such verification practice is widely employed for detection of forgeries, on checks or other commercial paper or documents, and may also be used as a means of identifying persons e.g. to prevent admission of unauthorized persons to restricted areas.

Visual comparison of signatures, however, affords at best a limited safeguard, as a skillfully forged signature is very difficult to detect by inspection. In many instances, it is necessary that a signature be verified promptly and rapidly, at the time and place at which it is written or presented, by persons relatively untrained in detection of forgeries; the frequently cursory and inexperienced nature of such visual comparison increases the likelihood that forgeries will pass undetected.

It has heretofore been proposed to avoid the shortcomings of visual comparison of signatures by utilizing certain characteristics of the manipulative acts involved in writing a signature as a determinant of authenticity. In U.S. Patent No. 3,113,461, there is disclosed a device for measuring the total time involved and the strength

and/or direction of forces applied in writing a signature on a portion of the device, to produce a numerical code representative of these factors. It has been found that such characteristics of the manipulative operations performed by a person in signing his own name are in the nature of instinctive or reflex actions, being repeated with relatively little variation each time he inscribes his signature, and also being clearly distinguishable from the acts of another person in writing the same signature (even though the forged signature may appear authentic), particularly because the forger in attempting to produce an appearance of authenticity necessarily "draws" the signature rather than utilizing natural writing motions. Accordingly, a signature written on the device may be verified by comparing the resulting numerical code with a record of a numerical code previously produced on the device by the writing of a signature known to be authentic.

Verification of signatures by use of such a device affords significantly better protection against failure to detect forgeries than visual comparison, but devices for measuring the above-mentioned combination of characteristics are complex in structure and operation and tend to be sensitive to extraneous stimuli, owing particularly to the necessary inclusion therein of instrumentalities for measuring the orientation of transverse writing force, i.e. force applied in directions parallel to the plane of the writing surface. The other measurements made by the device—total time involved in writing the signature, and total downward pressure exerted during writing of the signature—would not in themselves provide an adequately distinctive numerical code for desirably accurate signature verification, although they do provide a satisfactory code when taken together with the measurements of transverse direction of force.

SUMMARY OF THE INVENTION

An object of the present invention is to provide new and improved means for ascertaining the authenticity of a signature essentially immediately upon the writing of the signature, with superior freedom from failure in detection of forgeries. Another object is to provide apparatus advantageously simple in structure and operation for determining the authenticity of a signature by sensing certain characteristics of the act of writing the signature.

The writing of a signature involves application of pressure by a writing instrument to a writing surface for a succession of discrete pressure-applying intervals separated by periods during which the instrument is lifted from the surface. These pressure-applying intervals differ from each other in respect of various measurable characteristics, such as strength of applied pressure and duration. It is found that the particular sequence of such intervals involved in the writing of a given signature is a distinctive attribute of the person signing; i.e., a person under normal conditions will instinctively or reflexively reproduce essentially the same sequence of pressure-applying intervals (with minor variations) each time he signs his name, whereas another person forging the same signature will utilize a significantly different sequence of pressure-applying intervals.

The present invention in a broad sense contemplates the provision of signature-identifying apparatus comprising means responsive to pressure of a writing instrument on a surface for translating each of a sequence of pressure-applying intervals into a signal having a measurable value determined by a particular characteristic (e.g. duration) of such interval, thereby to produce for a given sequence of pressure-applying intervals a corresponding sequence of discrete signals of differing values; and means actuated by the signals for producing a display code rep-

representative of the values of the signals and the order of the signals in the sequence.

As a further feature of the invention, the code-producing means includes a plurality of devices each adapted to measure the cumulative value of signals applied to it, and means for sequentially applying the signals to these devices in a predetermined order, so that each of the devices receives and measures only certain of the signals in the sequence, the distribution of the signals among the several devices being determined by the order of the signals in the sequence.

In a particular embodiment of the invention, there are provided at least three electrical timing devices each adapted to measure, and to display as a numerical code, the cumulative time during which it is energized. These devices are interconnected in at least three sets, each including at least two but less than all of the devices; each timing device is included in more than one set, the sets differing from each other by exclusion of different ones of the devices. The apparatus further includes means for switching an electrical circuit between closed and open condition in correspondence with application of writing instrument pressure to a surface and removal of such pressure from the surface, and means for sequentially connecting the sets of timing devices into the circuit in a predetermined order in response to and in correspondence with successive closings of the circuit.

Each time the circuit is closed by application of writing instrument pressure, it energizes all the timing devices of the particular set therein connected, for a period of time equal to the duration of the pressure-applying interval. Thus, in operation of the described apparatus, application of the writing instrument to the writing surface at the start of the first pressure-applying interval in the act of writing a signature energizes a first set of the timing devices, which operate to record the duration of the interval and halt when they are de-energized by removal of the writing instrument from the surface. Upon re-application of the writing instrument to the surface at the start of the next pressure-applying interval, a second set of the timing devices is connected in the circuit (in place of the first set) and is concomitantly energized to record the duration of the interval. That is to say, each successive interval is measured by a different set of the timers, the sets being so arranged and connected that more than one but less than all the timers are energized during any given interval; for example, if three timers are used, they are so connected that only two of the three timers are energized at any one time. In this way, as the writing of the signature progresses with successive pressure-applying intervals, there is built up on the recording indicia of the several timing devices a code which is uniquely determined by the duration and order of the intervals in the sequence.

The code thus registered may be compared with a record of the code registered on the apparatus by a previous inscription of a known authentic signature, to provide immediate signature verification. Ordinarily, the codes registered by the same person signing his name at different times will differ from each other only very slightly, whereas the code registered by a different person forging the same signature will differ very substantially and obviously from that corresponding to an authentic signature. In consequence, rapid and accurate verification may be effected with little or no chance of failure to detect a forgery. The apparatus, having to sense only a single characteristic of the signature-writing operation (i.e. the duration of the individual pressure-applying intervals) is desirably simple and rugged in construction, free from excessive sensitivity in operation, and capable of use in a wide variety of circumstances by relatively untrained personnel.

Further features and advantages of the invention will be apparent from the detailed description hereinbelow set forth, together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of apparatus embodying the invention in a particular form;

FIG. 2 is a sectional elevational view of the apparatus of FIG. 1, taken along the line 2—2 of FIG. 1;

FIG. 3 is a cross-sectional view taken along the line 3—3 of FIG. 2;

FIG. 4 is a plan view of the stepping switch of the apparatus of FIG. 1, taken along the line 4—4 of FIG. 2;

FIG. 5 is a view taken along the line 5—5 of FIG. 4;

FIG. 6 is a view taken along the line 6—6 of FIG. 4;

FIG. 7 is a view taken along the line 7—7 of FIG. 5;

FIG. 8 is a view taken along the line 8—8 of FIG. 6;

and

FIG. 9 is a wiring diagram of the apparatus of FIG. 1.

DETAILED DESCRIPTION

Referring first to FIGS. 1—3, the apparatus of the invention in the form there illustrated is housed in a generally rectangular rigid casing 10 and is supported on a rigid rectangular base plate 11 to which the casing is secured as by screws 12. An elongated rectangular aperture 14 is cut through the top wall of the casing 10 to exposed a portion of a strip of paper 15. As shown in FIG. 3, the paper strip is supported on a flat horizontal writing plate 16 disposed within the casing in immediately subjacent relation to the aperture 14 and is supplied from a roll 18 rotatably mounted on a bracket 19 within the casing, the strip 15 being led upwardly from the roll over a guide 20, thence horizontally across the upper surfaces of the writing plate 16 and a further guide 21, and finally through a slot 22 in the casing side wall. In operation of the device, as hereinafter further explained, a signature to be verified is written on the portion of paper strip 15 exposed in aperture 14; after the signature is written the used portion of the strip may be removed, and a fresh portion of the strip may be drawn from roll 18 for exposure in aperture 14, simply by manually pulling the free end of strip 15 which projects through the slot 22.

The opposite ends of the writing plate 16 are respectively secured to a pair of parallel arms 24 which extend generally horizontally, beneath the top wall of the casing, at right angles to the long dimension of the aperture 14. These arms 24 are pivotally mounted, for rotation about a horizontal axis parallel to the long dimension of aperture 14, on fixed posts 25 secured to and projecting upwardly from the base plate 11, and are biased into the horizontal position shown in FIGS. 2 and 3 by means of small helical tension springs 27 acting between the posts 25 and the arms 24 respectively pivoted thereon; stop pins 28 are mounted on the posts 25 to engage the edges of arms 24 so as to prevent rotation of the arms beyond the horizontal position under the influence of the biasing force. This biasing force is arranged to urge the writing plate 16 upwardly and thus normally to hold the writing plate in horizontal position.

A metal contact point 29 is carried by the writing plate 16 and projects downwardly therefrom, being conveniently provided by a screw projecting downwardly through a small bracket 30 secured to the lower edge of plate 16. Immediately beneath point 29 is positioned a second contact point 32, also shown as a screw, mounted on a small plate 33 which is supported on a post 34 secured to and projecting upwardly from the base plate 11. Lead wires 36 and 37 are respectively connected to the contacts points 29 and 32, which together constitute a switch (designated 38) for closing and opening an electrical circuit.

In the upward (i.e. horizontal) position at which the writing plate 16 is ordinarily held by springs 27, the contact points 29 and 32 are slightly spaced apart vertically, and hence the switch 38 is open. However, each time a writing instrument is applied (as in writing a signature) to the portion of strip 15 exposed through aperture 14, the

downward pressure of the writing instrument on plate 16 overcomes the biasing force of springs 27 and causes the plate 16 to be depressed pivotally downwardly so as to bring point 29 into contact with point 32, closing the switch 38 and completing an electrical circuit through lead wires 36 and 37. When writing instrument pressure is removed from the plate 16, springs 27 rock the plate upwardly again to break the contact between points 29 and 32 and reopen the circuit.

Consequently, as a signature is written on the exposed portion of strip 15 by application of writing instrument pressure in a succession of discrete pressure-applying intervals, the switch 38 is closed during each such interval and is open during the periods between these intervals, when the writing instrument is lifted from the paper. In other words, the circuit through wires 36 and 37 is completed for a succession of discrete intervals respectively corresponding in duration and sequence to the aforementioned succession of pressure-applying intervals.

The apparatus illustrated is adapted to display, in response to the writing of a signature on the strip 15, a numerical code representative of the individual durations, and sequence, of the pressure-applying intervals involved in the writing of the signature. To produce and register this code, there are provided a plurality of timing devices, shown as three 3-drum timers of the "Geneva" counter type, respectively designated 39, 40 and 41. The timers are mounted in side-by-side relation at one end of the apparatus, being supported by a bracket 43 secured to the base plate 11, with their faces exposed through an opening 44 in the adjacent end wall of the casing 10 so that their time-registering windows (respectively designated 45, 46 and 47) are readily visible. Each of these timers is adapted to be connected in an electrical circuit and to measure and register, in sixtieths of a second, the cumulative time such circuit is energized by passage of current therethrough. As will be appreciated, the described timers are individually conventional, commercially available units; their construction and operation are well known to those skilled in the art, and accordingly need not be described in detail.

Further in accordance with the invention, the timers 39, 40 and 41 are actuated in a particular predetermined sequence (hereinafter more fully described), in response to and in correspondence with successive closings of the writing plate switch 38, by means shown as a conventional form of stepping switch generally designated 50, mounted on the base plate 11. Specifically, in this embodiment having three timers the stepping switch is so arranged and connected to the timers that only two of the three timers are energized at any one time.

As more particularly illustrated in FIGS. 4-8, the stepping switch 50 includes a plurality of separate point contacts 52 positioned in regular spaced relation along a circular path on a flat plate 53 which also bears a continuous annular contact 54 disposed in spaced concentric relation to the circular path containing contacts 52. A wiper rotor 56, bearing a metal wiper 57, is mounted on a shaft 58 for rotation about an axis coincident with the center of the aforementioned circular path. The wiper 57 has two prongs, of which the shorter (designated 60) moves in continuous engagement with the annular contact 54, and the longer (designated 61) moves along the circular path successively into engagement with each of the separate point contacts 52, as the wiper rotates; thus the wiper serves to provide electrical connection between the annular contact and each of the point contacts in succession during such rotation.

The shaft 58 is surrounded by a flanged bearing 63 which rotates with the shaft and is journaled in a fixed plate 64. Shaft 58 also carries a ratchet wheel 65 having teeth 66 corresponding in number and angular spacing to the contact points 52. The assembly comprising wheel 65, shaft 58 and wiper rotor 56 is biased by a helical spring 68 (surrounding the bearing 63, and having op-

posite ends respectively connected to the wheel 65 and fixed plate 64) for rotation in a counterclockwise direction as seen in FIG. 7, but is held against such rotation by a pawl 70 pivotally mounted on the plate 64.

Stepped clockwise rotation of the wiper rotor 56, against the biasing force of spring 68, is effected by a lever 72 which is controlled by an electromagnet 74. The lever is mounted for movement (in a plane perpendicular to the plane of ratchet wheel rotation) into and out of engagement with the teeth of the ratchet wheel, being biased by springs 75, 76 in an upward position away from engagement with the ratchet wheel teeth. Each time the electromagnet 74 is energized, it attracts the lever 72 downwardly, causing the lever to engage the subjacent tooth of the ratchet wheel and to advance the ratchet wheel clockwise (as seen in FIG. 7) by an amount equal to the distance between successive teeth. Upon de-energization of the electromagnet 74, the biasing springs 75 and 76 raise the lever again, but pawl 70 holds the wheel in the new position to which it has been advanced by the lever, so that when the electromagnet is re-energized, the lever 72 engages the next tooth of the ratchet wheel to advance the wheel by a further distance again equal to the spacing between successive teeth. The orientation of the wiper prong 61 in relation to the ratchet wheel is such that upon each stepped advance of the wheel, i.e. each time the electromagnet 74 is energized, prong 61 is advanced from engagement with one point contact 52 into engagement with the next adjacent point contact and there held (by pawl 70) until the ratchet wheel is again advanced by lever 72.

A second lever 79, controlled by a second electromagnet 80 and normally held away from contact with the pawl 70 by a biasing spring 81, is disposed and adapted to rock the pawl out of engagement with the ratchet wheel when moved into contact with the pawl by energization of electromagnet 80. Concomitantly, the lever 79 moves a pivoted rocker arm 82 into engagement with the lower surface of the lever 72 to lift the latter lever away from the ratchet wheel (in the event that lever 72 is in its lower, tooth-engaging position when the electromagnet 80 is energized) so as to free the ratchet wheel for unobstructed rotation. When the pawl releases the ratchet wheel, spring 68 rotates the ratchet wheel counterclockwise (as seen in FIG. 7) until a stop 83 carried by the ratchet wheel engages a projection 84 on the fixed plate 64; the position of the wheel at which stop 83 engages projection 84 is the zero or starting position of the ratchet wheel. De-energization of the magnet 80 returns lever 79 to its normal biased position and thereby restores engagement of the pawl with the ratchet wheel.

Referring now to the wiring diagram (FIG. 9), it will be seen that the timing devices 39, 40 and 41 are connected in pairs to the several point contacts 52 of the stepping switch, in a particular sequence such that no two successive point contacts are connected to the same pair of timing devices. In the arrangement shown, timers 39 and 40 are connected, respectively through rectifiers 86 and 87, to a common lead 88 to constitute a first pair of timers; the same timer 39 and timer 41 are separately connected, respectively through rectifiers 90 and 91, to a common lead 92 to constitute a second pair; and the timers 40 and 41 are also separately connected, respectively through rectifiers 94 and 95, to a common lead 96 to constitute a third pair.

The prong 61 is represented in FIG. 9 as being in the zero position, i.e. before stepwise advance thereof into successive engagement with the point contacts 52, such advance (which would be clockwise as seen in FIG. 7) being counterclockwise in the view of FIG. 9. Stated with reference to the order in which the point contacts 52 are engaged by prong 61, the first, fourth, seventh and tenth of these point contacts are connected to lead 88 (timers 39 and 40), while the second, fifth, eighth and

eleventh point contacts are connected to lead 92 (timers 39 and 41) and the third, sixth, ninth and twelfth point contacts are connected to lead 96 (timers 40 and 41). Thirteen point contacts 52 are shown by way of illustration in FIG. 9, the thirteenth and last point contact being connected to the electromagnet 80.

The annular contact 54 of the stepping switch 50 is connected through the writing plate switch 38 to a suitable 110-volt, 60-cycle A.C. power supply 98, e.g. by means of a conventional cord and plug 99 (FIG. 1). The power supply, which may be turned on and off by a switch 100 mounted on the casing 10 (as shown in FIG. 1), is also connected to the timers through a rectifier 102. Accordingly, when the writing plate switch 38 is closed (by depression of the writing plate, bringing points 29 and 32 into contact) and wiper prong 61 is in engagement with any given one of the contact points 52, the wiper 57 connecting annular contact 54 with that given contact point completes a circuit from the power supply through the particular pair of timers connected to such contact point, causing those two timers to be energized. The arrangement of rectifiers 86, 87, 90, 91, 94, 95 and 102 prevents energization of the third timer; i.e. that one of the timers which is not connected to the aforementioned given contact point remains idle, only two of the three timers being energized at any one time. As long as the writing plate switch continues to be closed, the two timers thus connected in the power supply circuit continue to operate, registering elapsed time of energization, but cease operation when the writing switch reopens and thereby disconnects them from the power supply.

The electromagnet 74, which as already explained controls stepwise advance of the stepping switch wiper, is connected to the power supply 98 in series with the writing plate switch 38 and in parallel with the stepping switch and timers. Each time the writing plate switch is closed, therefore, the electromagnet 74 is energized to advance the wiper prong 61 from one point contact 52 to the next successive point contact. Consequently, each successive closure of the writing plate switch effects energization of a different pair of the timers (or in other words, excludes a different one of the three timers from the energizing circuit) in accordance with the sequence of connections of the pairs of timers to the point contacts 52.

The electromagnet 80 is connected between the power supply and the last of the point contacts 52. When the wiper prong 61 reaches this last point contact, a circuit is completed from the power supply through the wiper plate switch, stepping switch, and electromagnet 80, energizing the latter electromagnet to cause release of the ratchet wheel 65 by pawl 70 (and concomitantly by lever 72), with the result that the wiper prong 61 is returned to the zero position by the action of spring 68. Electromagnet 80 is also separately connected to the power supply through a stepping-switch reset switch 104 (mounted on the casing 10, as shown in FIG. 1) bypassing switch 38 so that this electromagnet may be energized to reset the stepping switch to zero position when desired, i.e. by closure of the switch 104, without regard to the position of the stepping switch wiper or closure of the writing plate switch.

Each of the timers includes electrically operated means of conventional character for resetting its registering drums to zero after the drums have moved from zero position to register elapsed time of energization. The resetting means of the three timers are connected to the power supply 98 through a circuit including a rectifier 106 having an electrolytic capacitor 107 connected across its terminals, this circuit being controlled by a reset switch 108 also mounted on the casing 10 as shown in FIG. 1. Closure of switch 108, with the power supply turned on, simultaneously restores the registers of all three timers 39, 40 and 41 to zero position.

The operation of the described apparatus will now be

readily apparent. With a fresh portion of the paper strip 15 exposed in the aperture 14 and the power supply switch 100 turned on, the signature to be authenticated is written, with any suitable writing instrument such as a ballpoint pen, on the exposed strip. The stepping switch and timers are both initially set to their respective zero positions. As the writing instrument is initially brought to bear on the paper strip 15, at the start of the first pressure-applying interval involved in forming the signature, the writing plate is depressed so as to close switch 38, energizing the electromagnet 74 and thereby advancing wiper prong 61 to the first of the contact points 52.

The first pair of timers, 39 and 40, are accordingly energized and begin to register elapsed time in sixtieths of a second, continuing to operate until the writing instrument is lifted from the paper 15 at the end of the first pressure-applying interval. Timers 39 and 40, at the conclusion of such interval, indicate the duration thereof (in sixtieths of a second) while timer 41, which remains idle during the first interval, continues to register zero.

Return of the writing instrument to the paper to initiate the second pressure-applying interval again closes the writing plate switch 38, re-energizing the electromagnet 74 to advance the wiper prong 61 to the second of the contact points 52 and thus to energize timers 39 and 41. Timer 40 remains idle during the second interval. At the conclusion of this second interval, i.e. when the writing instrument is removed from the paper and the writing plate switch reopens, timer 39 registers the cumulative duration of the first and second intervals, timer 40 registers the duration of the first interval only, and timer 41 registers the duration of the second interval only.

This operation is repeated for each following pressure-applying interval, with the wiper prong 61 advancing from one point contact 52 to the next at the start of each interval so that the durations of the successive intervals are sequentially registered on the various pairs of timers connected to these contacts. If more than twelve pressure-applying intervals are involved in the writing of the signature, advance of the wiper prong to the thirteenth and last point contact energizes the electromagnet 80 to return the wiper prong to zero position and thence (at the start of the next interval) again to the first point contact, to continue the sequential measurement of interval duration by the timers.

At the end of the signature-writing operation, each of the timers registers the cumulative elapsed time of those pressure-applying intervals during which it was energized, and since the several timers are energized in a particular sequence, the readings of the three timers taken together is determined both by the durations of the individual intervals and by the particular order in which these intervals occur in the sequence of intervals. Thus the readings of the three timers constitute a digital code by which the authenticity of the signature may be determined.

To verify the signature, the reading produced on the timers is compared with the record of a reading previously produced by the writing of a signature known to be authentic. Since the stepping switch is reset to zero prior to inscription of each signature, the timers are actuated in the same sequence each time the same succession of pressure-applying intervals is applied to the writing plate. Thus, in the case of any given person writing his own name, approximately the same reading or code will be produced on the timers each time he does so, with variations of ordinarily not more than about 1 or 2%. On the other hand, another person forging the same signature will employ a significantly different sequence of intervals, and the resultant reading on the timers will differ from that for an authentic signature by as much as 25 to 30%.

At the conclusion of inscription of each signature,

and prior to the writing of the next, the paper strip 15 is advanced to present a fresh portion of paper in the aperture 14, and the timer and stepping-switch reset switches are depressed to return the timers and the stepping switch to their respective zero positions.

For insured accurate and repeatable measurement of the duration and sequence of intervals involved in writing a signature, it is preferred that the paper strip 15 be constituted of a paper having appropriate surface characteristics to prevent slippage of the writing instrument thereon, since the extent of slippage might vary from time to time and produce corresponding variations in the time measurement of individual intervals. A suitable writing instrument is a ballpoint pen of the type commonly known as having a serrated ball.

By way of further and more specific illustration of the invention, reference may be made to an example of operation of the apparatus during the inscription of a particular (hypothetical) signature, writing if which involves a succession of eight pressure-applying intervals of varying length separated by periods during which the writing instrument is lifted from the paper. The manner in which the digital code is built up on the three timers of the apparatus described above, as the writing instrument engages the paper during these eight intervals, will be apparent from the following table, in which—for purposes of example only—hypothetical durations of the successive intervals are set forth and the timer readings at the end of each of these exemplary intervals are given:

Interval	Duration (sixtieths of a second)	Timers actuated	Timer reading at end of interval		
			39	40	41
1-----	10	39, 40	010	010	000
2-----	35	39, 41	045	010	035
3-----	25	40, 41	045	030	060
4-----	8	39, 40	053	043	060
5-----	2	39, 41	055	043	062
6-----	8	40, 41	055	051	070
7-----	45	39, 40	100	096	070
8-----	12	39, 41	112	096	082

While apparatus utilizing three timers of a particular character has been shown, it will be appreciated that other elapsed-time-measuring devices may be employed in their place, and that the apparatus may include more than three such devices, interconnected in groups each comprising more than one but less than all of the devices, and arranged to be sequentially energized so that different groups of the devices measure different intervals in a particular sequence, i.e. so that different ones of the devices remain idle during different intervals. Also, characteristics other than duration (e.g. strength of applied pressure), whereby the pressure-applying intervals may be distinguished from each other, may be measured in sequential manner by a plurality of measuring devices to produce a digital or other code representative of the particular sequence of intervals involved in the writing of a given signature.

It is to be understood that the present invention is not limited to the features and embodiments herein set forth but may be carried out in other ways without departure from its spirit.

I claim:

1. In apparatus for determining the authenticity of a signature or like writing made by application of pressure by a writing instrument on a writing surface in a succession of discrete pressure-applying intervals differing from each other in respect of a particular characteristic, in combination,

(a) means responsive to pressure of said instrument on said surface for translating each pressure-applying interval into a signal having a measurable value determined by the particular characteristic of such interval, thereby to provide for said succession of intervals a corresponding sequence of discrete signals of respectively differing values; and

(b) means actuated by said signals for producing a code representative of and determined by the values of the signals and the chronological order in which the signals occur in said sequence.

2. Apparatus as defined in claim 1, wherein the value of each signal is dependent on the duration of the pressure applying interval to which it corresponds.

3. In apparatus for determining the authenticity of a signature or like writing made by application of pressure by a writing instrument on a writing surface in a succession of discrete pressure-applying intervals differing from each other in respect of a particular characteristic, in combination,

(a) means responsive to pressure of said instrument on said surface for translating each pressure-applying interval into a signal having a measurable value determined by the particular characteristic of such interval, thereby to provide for said succession of intervals a corresponding sequence of discrete signals of respectively differing values; and

(b) means actuated by said signals for producing a code representative of the values of the signals and the order of the signals in said sequence, said code-producing means comprising a plurality of signal-measuring devices each adapted to produce a code representative of the cumulative value of signals applied thereto, and means for sequentially actuating said devices by selectively applying thereto successive signals of said sequence in a predetermined order.

4. Apparatus as defined in claim 3, wherein said measurable value of each signal is the duration thereof, and wherein each of said devices is adapted to measure the cumulative duration of signals applied to it.

5. In apparatus for determining the authenticity of a signature or like writing made by application of pressure by a writing instrument on a writing surface in a succession of discrete pressure-applying intervals differing from each other in respect of a particular characteristic, in combination,

(a) means responsive to pressure of said instrument on said surface for translating each pressure-applying interval into a signal having a measurable value determined by the particular characteristic of such interval, thereby to provide for said succession of intervals a corresponding sequence of discrete signals of respectively differing values;

(b) at least three devices for measuring the value of said signals, each of said devices being adapted to produce a code representative of the cumulative value of signals applied to it, said devices being interconnected in a plurality of sets each including at least two of said devices and excluding at least one of said devices, different ones of said devices being excluded from different sets; and

(c) means for sequentially actuating said sets by selectively applying thereto successive signals of said sequence in a predetermined order.

6. Apparatus as defined in claim 5, wherein the total number of said sets is equal to the total number of said devices, and the number of said devices in each of said sets is one less than the total number of said devices.

7. In apparatus for determining the authenticity of a signature or like writing made by application of pressure by a writing instrument on a writing surface in a succession of discrete pressure-applying intervals of varying duration, in combination,

(a) means responsive to pressure of said instrument on said surface for translating each pressure-applying interval into an electrical signal equal in duration to such interval, thereby to provide for said succession of intervals a sequence of discrete signals respectively corresponding in duration to said intervals;

(b) a plurality of devices for measuring the duration of said signals, each of said devices being arranged

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and adapted to register the cumulative duration of signals applied to it; and

(c) means for sequentially actuating said devices by selectively applying thereto successive signals of said sequence in a predetermined order, in response to and in correspondence with initiation of the successive signals.

8. Apparatus as defined in claim 7, wherein said pressure-responsive means includes means for supplying an electric current to an electrical circuit, and switch means for closing and opening said circuit in response to application of writing instrument pressure to, and removal of writing instrument pressure from, said surface; wherein each of said signal-measuring devices is adapted to register the cumulative time during which an electric current is passed through it; and wherein said signal-applying means comprises means for sequentially connecting said signal-measuring devices in said circuit in response to and in correspondence with successive closures of said switch means.

9. Apparatus as defined in claim 8, wherein said switch means comprises a writing plate providing said writing surface and mounted to undergo depression in response to application of writing instrument pressure to said sur-

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face, said plate being biased away from its depressed position; and a pair of switch contacts, of which one is carried by said writing plate and the other is mounted in a fixed position to engage said one contact upon depression of said writing plate as aforesaid.

10. Apparatus as defined in claim 8, including at least three of said signal-measuring devices, said devices being interconnected in at least three sets each including at least two of said devices and excluding at least one of said devices, different ones of said devices being excluded from different sets; and wherein said signal-applying means comprises means for sequentially connecting said sets in said circuit in response to and in correspondence with successive closures of said switch means.

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