

Feb. 25, 1969

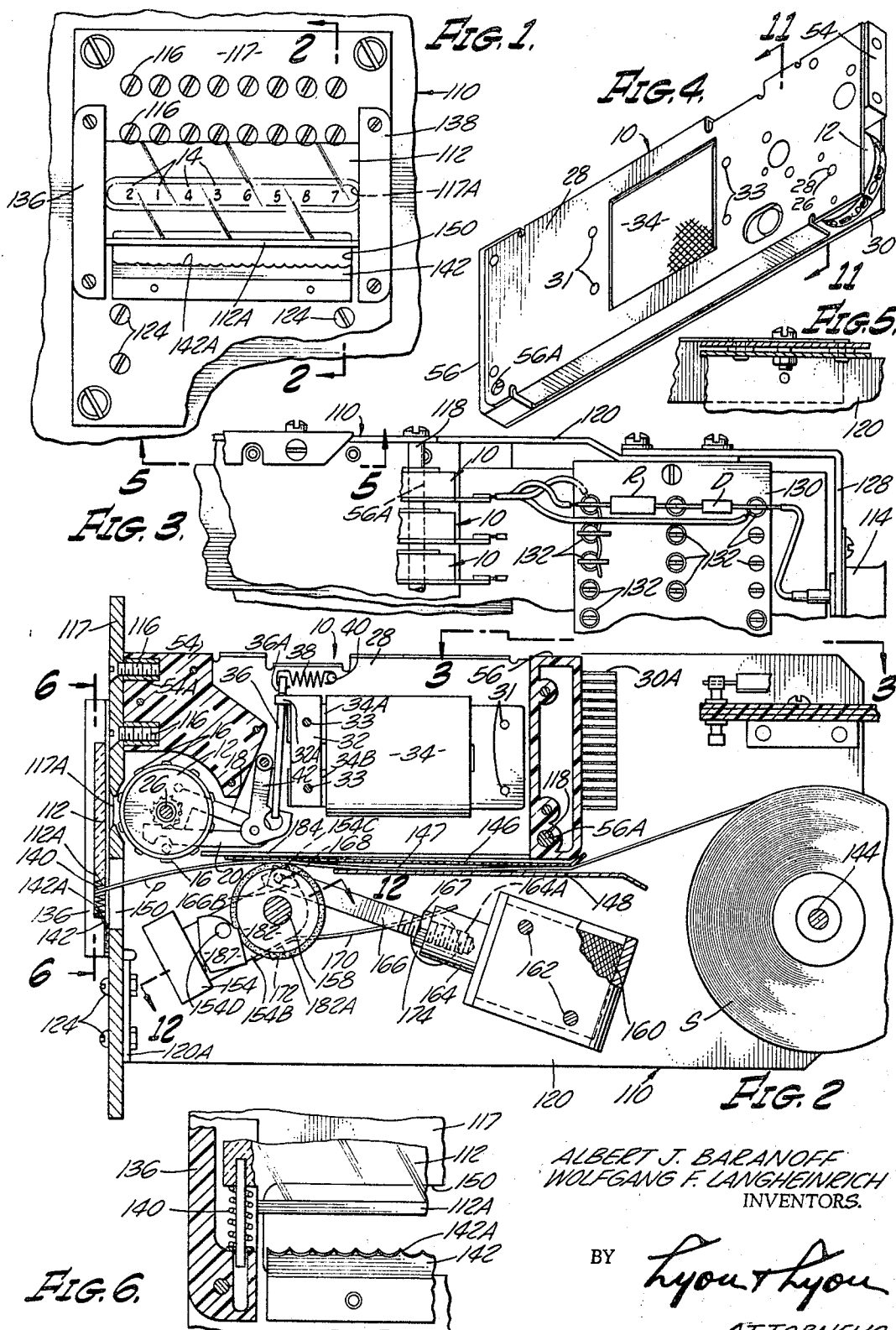
A. J. BARANOFF ET AL

3,429,258

ELECTRICALLY ACTUATABLE COUNTER-PRINTER ASSEMBLY

Original Filed Sept. 27, 1966

Sheet 1 of 4



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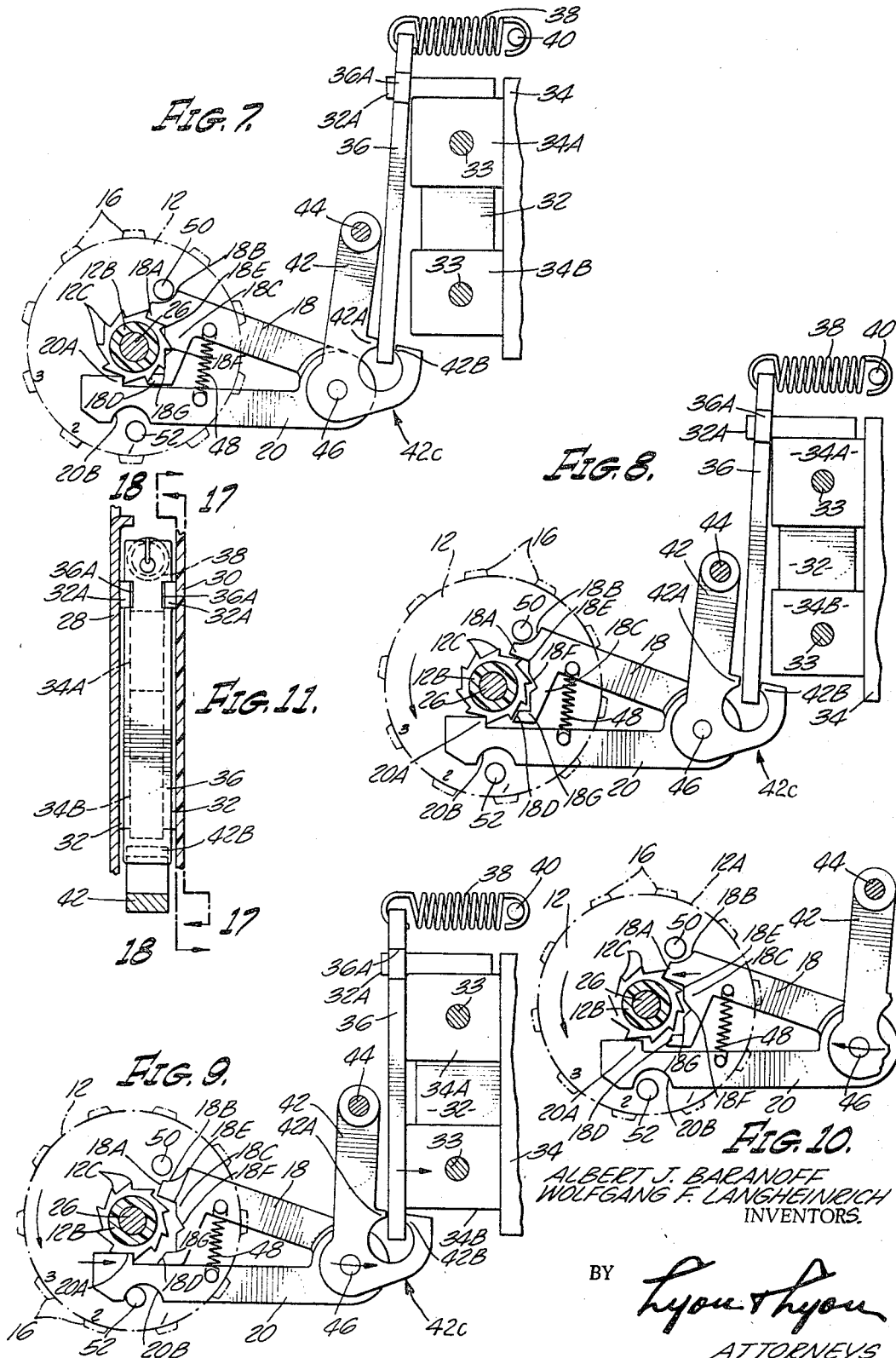
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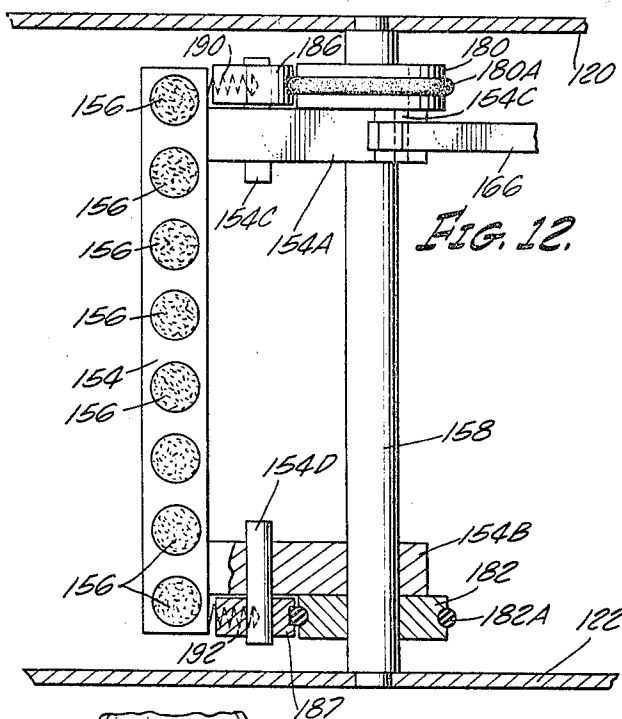


FIG. 12.

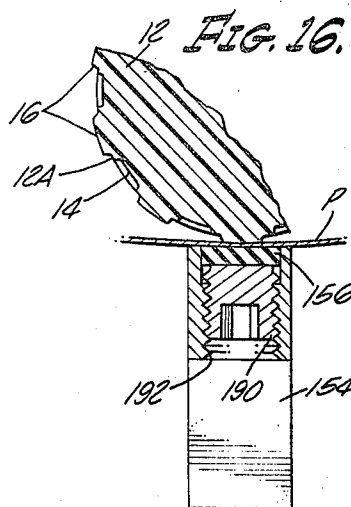


FIG. 16.

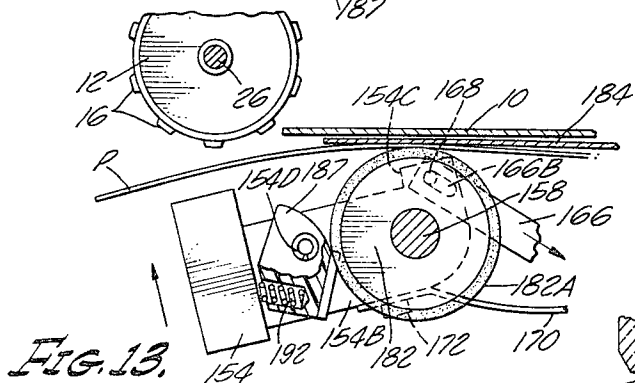


FIG. 13.

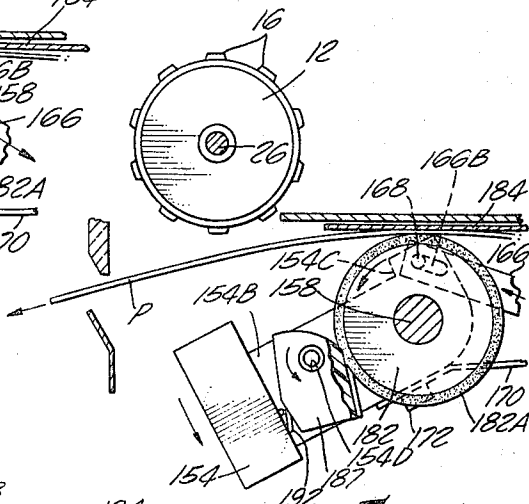


FIG. 15.

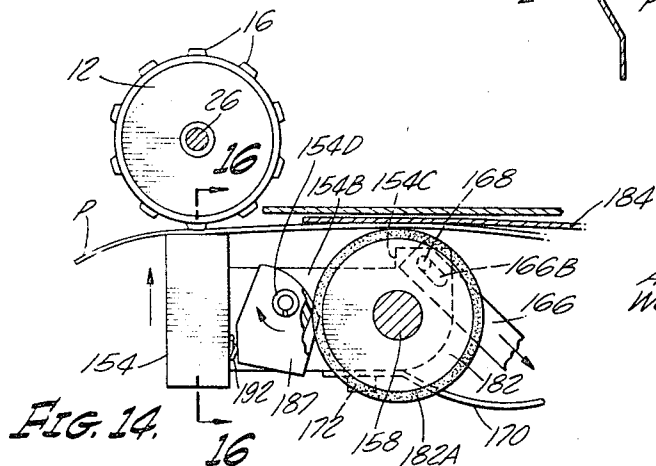


FIG. 14.

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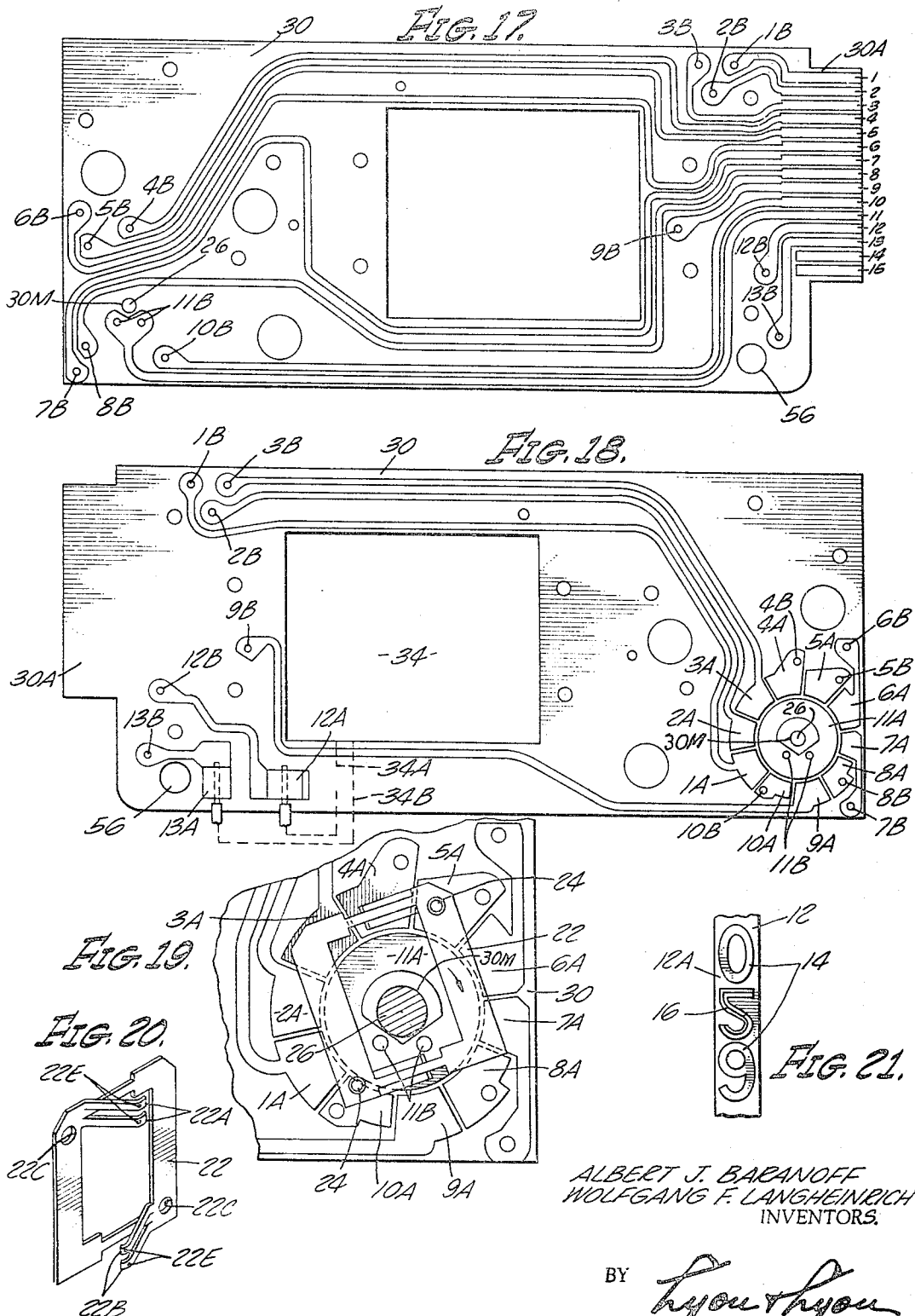
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Sheet 4 of 4



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3,429,258

ELECTRICALLY ACTUATABLE COUNTER- PRINTER ASSEMBLY

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Continuation of application Ser. No. 582,399, Sept. 27, 1966. This application Apr. 10, 1968, Ser. No. 720,409 U.S. Cl. 101—79

22 Claims

Int. Cl. B41l 45/00; B41j 1/60; B41f 1/08

ABSTRACT OF THE DISCLOSURE

A counter wheel with indicia for visual readout and also for printing is mounted between a pair of spaced plates and such counter wheel is rotated equal incremental arcuate distances upon corresponding successive energization of electromagnetic means mounted between the spaced plates. One of such plates is a printed circuit board having conducting portions thereof cooperating with a brush carried by the counter wheel. A plurality of such assemblies or modules each having an individual counter wheel may be assembled in side-by-side relationship in modular form so that when one wheel is rotated a full revolution corresponding, for example, to 10 incremental distances an adjacent counter wheel may be moved one-tenth of one revolution. Each of such electromagnetic means involves a pawl and ratchet arrangement which assures proper indexing of the counter wheel for accurate visual readout and printing purposes. The counter wheel brush has bifurcated portions of unequal lengths so as not to be naturally resonant at the same frequency.

This application is a continuation of application Ser. No. 582,399, filed Sept. 27, 1966, now abandoned.

The present invention relates to an assembly in which one or more decade counters is used for visual display of a count and/or for printing a permanent record, and for electrically conveying count information to a remote location, or conversely, permitting self-positioning of the counter wheel to agree with a unique combination of remote electrical switch or voltage conditions.

Briefly, the assembly described herein includes a frame or supporting structure within which a plurality of identical decade counters may be easily and quickly mounted for both visual indication and/or for printing of a permanent record. The supporting frame or structure includes a front plate having an apertured portion through which the count of the assembled counters may be displayed and below such apertured portion there is an opening through which paper with information printed thereon is accessible. One feature of the construction is that the last number printed on the paper is readable from the paper while at the same time the same numeral is visible through the window of the front panel. Each individual decade counter unit is operated by application of a current pulse and each incorporates novel pawl and ratchet escape mechanism for assuring proper movement and indexing of the numerals such that the numerals of all of the decade counter units are properly aligned and maintained in proper alignment during printing operations. The assembly includes also a novel paper feeding and printing mechanism using pressure sensitive paper in such a manner that clear imprints are registered on the paper, this being accomplished using a unique arrangement whereby the printing operation at each individual counter wheel may be accurately adjusted to compensate for any misalignment in the assembly. Another important feature of the construction involves the provision whereby information as to the position of the

counter wheels may be conveyed to a remote location over interconnecting wiring.

It is therefore a general object of the present invention to provide an improved electrical counter assembly of the character indicated above.

A specific object of the present invention is to provide an improved counter assembly of this character using novel constructional features in the individual decade counter units which assures accurate indexing of the numerals on a printing wheel.

Another specific object of the present invention is to provide a counter assembly of this character which includes means for conveying information with respect to the position of the individual counter wheels to a remote location over interconnecting wiring.

Another specific object of the present invention is to provide an assembly of this character which permits assembly of individual units in modular form with the overall width of the assembly being determined by the amount of data which is required to be displayed and/or printed and/or conveyed to a remote location.

Another specific object of the present invention is to provide a counter assembly of this character in which the decade counters, for each printed column desired, are mounted with respect to each other in a unique manner for ease of assembly and disassembly for repair, replacement or for other purposes.

Another specific object of the present invention is to provide an assembly of this character which is capable of accommodating different numbers of decade counters.

Another specific object of the present invention is to provide an assembly of this character which is rugged so as to withstand impact forces generated during printing while yet allowing easy interchange of decade units.

Another specific object of the present invention is to provide an assembly of this character which allows the use of pressure sensitive or carbon interleaved paper tape.

Another specific object of the present invention is to provide an assembly of this character in which the information printed out is immediately visible, i.e., the last printout being always visible and also the data being accumulated prior to the next printout being also continuously visible.

Another specific object of the present invention is to provide an assembly of this character whereby uniformity of printout is assured using a unique arrangement that permits instant and positive adjustment of the impact applied to each column (decade) during printout.

Another specific object of the present invention is to provide an assembly of this character which is expandable in the sense that more or less than a particular number of counters may be employed without affecting the basic design.

Another specific object of the present invention is to provide an assembly of this character which permits either serial or parallel data entry.

Another specific object of the present invention is to provide an assembly of this character in which an integral circuit board is provided for the mounting of any desired arc suppression, reset and transfer circuit components.

Another specific object of the present invention is to provide an assembly of this character which is readily adaptable to become a plug-in unit.

Another specific object of the present invention is to provide a novel mechanism for positioning a counter wheel incorporating means for returning the counter wheel from an intermediate position to an initial numerical position when an actuating pulse is of too short a duration or otherwise fails to complete the movement from such initial numerical position to a successive numerical position.

Another specific object of the present invention is to provide a novel electrical contact arrangement involving a bifurcated contact so as to assure remote indications under all extreme conditions.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. This invention itself, both as to its organization and manner of operation, together with further objects and advantages thereof, may be best understood by reference to the following description taken in connection with the accompanying drawings in which:

FIGURE 1 is a plan view showing a portion of the front panel on an assembly embodying features of the present invention;

FIGURE 2 is a sectional view taken through the same as indicated by the lines 2—2 in FIGURE 1;

FIGURE 3 is a top plan view of a portion of the same taken in the direction as indicated by the lines 3—3 in FIGURE 2;

FIGURE 4 is a perspective view illustrating one of the eight decade counter units which is assembled in the arrangement shown in FIGURE 1;

FIGURE 5 is a view taken as indicated by the lines 5—5 in FIGURE 3;

FIGURE 6 is a view taken generally as indicated by the lines 6—6 in FIGURE 2;

FIGURES 7, 8, 9 and 10 illustrate details of the counter wheel advancing and indexing mechanism in various operating positions; FIGURE 7 illustrating the parts in their normal rest position, i.e., long after an electrical current operating pulse has been applied and removed, FIGURE 9 illustrating the parts after an electrical magnet has been energized and the associated armature has been moved to its fully attracted position, and FIGURES 10 and 7 in that order illustrate the relative position of the parts when and as the armature is being returned from its attracted position shown in FIGURE 9 to its normal unattracted position shown in FIGURE 7 and FIGURE 8 illustrating a short pulse condition in which the incompletely advanced counter wheel will reset the wheel from an intermediate position to an initial numerical position in which a number is in proper position for display and/or printing;

FIGURE 11 is a sectional view taken through one of the decade units and substantially along the line 11—11 of FIGURE 4;

FIGURE 12 is a sectional view taken substantially as indicated by the lines 12—12 in FIGURE 2;

FIGURES 13, 14 and 15 illustrate parts shown also in FIGURE 2 in different operating positions during the printing operation;

FIGURE 16 is a sectional view taken substantially as indicated by the lines 16—16 in FIGURE 14;

FIGURES 17 and 18 illustrate opposite sides of the printed circuit board in a decade unit and correspond generally to views taken as indicated by the corresponding lines 17—17 and 18—18 in FIGURE 11;

FIGURE 19 is an enlarged view showing a portion of the printed circuit of FIGURE 18 in relation, however, to the brush and counter wheel shaft;

FIGURE 20 is a perspective view of the brush illustrated also in FIGURE 19;

FIGURE 21 illustrates a portion of the counter wheel with a raised printing character interposed between two inscribed characters used for visual indication.

COUNTER CONSTRUCTION

Each one of the eight counter structures 10 assembled in a common holder, frame, or supporting structure 110 is of identical construction and is thus interchangeable, and a description of one of such counter structures 10 suffices as a description of the other seven.

The counter structure 10 involves a counter wheel 12 having two sets of indicia 14, 16 on its peripheral portion, one of such sets of indicia 14, for visual indicating

purposes, consisting of numerals 0—9 inscribed within the circular peripheral portion 12A of wheel 12; and the other set 16, for printing purposes, consists of smaller raised numerals 0—9 raised or extending out of such circular peripheral portion. One each of numerals of the first set 14 is visible through a rectangular piece of glass 112 (FIGURE 1) mounted on the common supporting frame 110. Since printing as described later occurs at a different location than that location at which visual observations are normally made, the printing numerals of the second set 16 are displaced with respect to and lie between numerals of the first visible set 14 so that, for example, the printing numeral 0 lies between the visible numerals 7 and 8, the printing numeral 1 lies between the visible numerals 8 and 9, etc.

The counter wheel 12, as seen in FIGURE 7, on one side thereof has an integrally formed hub portion 12B on the periphery of which is formed ten ratchet teeth 12C for cooperative engagement with a pair of pawl elements 18, 20, and the other side of wheel 12 carries a generally rectangular apertured metal plate 22 from which resilient electrical brush elements 22A, 22B extend for electrical contact with a printed circuit as described later, the plate 22 of spring material being secured to the wheel 12 by rivets 24 passing through plate apertured portions 22C.

The counter wheel 12 is rotatably mounted on a pin 26 having its opposite ends secured to the spaced plates 28, 30, the plate 28 being of metal and the other plate 30 being of insulated material on both sides of which an electrical circuit is printed and hence plate 30 may be referred to as a printed circuit board. The pin 26 has its opposite ends protruding through apertured portions 28M (FIG. 4) and 30M (FIGS. 17, 18 and 19) of such spaced plates 28 and 30 respectively and various expedients, as well known to those skilled in the art, may be used to retain the pin 26 in such apertured portions 28M, 30M as, for example, by providing shouldered portions on the pin engaging the inner adjacent faces of plates 28 and 30 or, for example, by forming enlarged portions of the pin. The particular manner in which such pin 26 is mounted and secured forms no part of the present invention.

The wheel 12 is capable of being advanced and indexed incremental distances corresponding to 36 degrees ($\frac{1}{10}$ of 360°) using an electromagnetically operated stepping mechanism which involves the previously-mentioned pawl elements 18, 20 and also an electromagnet 34. Electromagnet 34 is mounted on plate 28 by rivets 31 and has spaced pole pieces 34A, 34B with an associated pivoted armature 36 which has two notched portions 36A for pivoting at a point intermediate its ends on a pair of extensions 32A of spaced brass straps 32 secured by rivets 33 to pole pieces 34A, 34B. One end of armature 36 is attached to one end of coil tension spring 38 having its other end attached to stationary post 40. The other end of armature 36 extends loosely between spaced portions 42A, 42B of yoke portion 42C of a first lever member 42. Lever member 42 is pivoted on post 44 on plate 28 (FIGURE 2) and, in turn, the pawl elements 18, 20 comprising second and third levers respectively are pivotally mounted about the axis of a common pivot pin 46 carried by lever member 42. Pawl elements 18, 20 are urged together by a coil tension spring 48 having its ends attached to intermediate portions of such elements or levers 18, 20. The free ends of elements 18, 20 are engageable respectively with stationary stop posts 50, 52 secured on metal plate 28 and are shaped to assure proper stepping and indexing of the counter wheel 12 once per energization of electromagnet as described later.

The printed circuit board 30 is secured to the metal plate 28 with spacers 54, 56 therebetween each of insulating material, using a plurality of rivets. The front spacer 54 is formed with two threaded metal inserts 54A and the rear spacer 56 is formed with an apertured portion 56A (which is aligned with like holes in plates 28, 30)—

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all for purposes of easy mounting of the individual counters in the supporting structure 110 for convenient assembly and disassembly when repair and/or replacement is desired.

With regard to the electrical circuitry on board 30 it will be seen that the board 30 is extended rearwardly and has 15 parallel extending metal portions on extension 30A, and such metal portions may be used for cooperation with contacts (not shown) of a plug or as illustrated herein as soldering terminals for connection to a multicontact plug 114 (through resistances R or diodes D if desired) on supporting structure 110.

These 15 parallel extending metal portions, contacts or terminals on board extension 30A are numbered consecutively 1-15 in FIGURE 17. It will be seen from FIGURES 17 and 18 that terminals 1, 2, 3 are connectable to metal printed sectors 1A, 2A, 3A through adjacent eyelet pairs 1B, 2B, 3B respectively on opposite sides of board 30. Likewise terminals 4, 5, 6 are connectable to sectors 4A, 5A, 6A through eyelet pairs 4B, 5B, 6B respectively; and similarly terminals 7, 8, 9, 10 are connectable to sectors 7A, 8A, 9A, 10A through corresponding eyelet pairs 7B, 8B, 9B, 10B, such eyelet pairs being connectable as, for example, by inserting a wire through the apertured portion and then soldering the same to adjacent conducting portions on opposite sides of the board. Terminal 11 is connectable to the inner circular sector 11A through eyelets 11B. Terminals 12 and 13 are used for supplying current to the electromagnet 34 which has its leads 34A, 34B connectable with the electromagnet terminals 12A, 13A through corresponding eyelets 12B, 13B. Terminals 14, 15 are shown unconnected. Instead of using eyelets the circuit board may be provided with plating of conductive material in the apertured portion between sides of the board.

For operation of the counter a D.C. voltage is applied to terminals 12, 13 (FIGURE 17), i.e., to electromagnet 34 which when thus supplied with an energizing current, causes its armature 36 to be attracted to its pole pieces to thereby cause the armature to be pivoted in a counterclockwise direction from its normal position shown in FIGURE 7 to its attracted position shown in FIGURE 9.

During this latter movement of armature 36 the yoke member is pivoted also in the counterclockwise direction to move the levers or pawl members 18, 20 in a direction which is generally to the right in FIGURES 7 and 9 to thereby cause the counter wheel to move in a counterclockwise direction in FIGURES 7 and 9 through substantially one-half of its travel, i.e., one half of 36° or 18°. Such movement occurs as a result of engagement of the projection 20A on the end of pawl element 20 engaging a ratchet tooth 12C, such engagement being assured during the full travel by the force exerted by the spring which urges the levers 18, 20 together and also to some extent by engagement of the cam notch portion 20B of lever 20 with the stationary stop post as shown in FIGURE 9. Then, after the current flow to the electromagnet 34 is interrupted the armature 36 is returned to its normal position under the influence of its restoring spring 38. During such return movement the end portion 18A of lever 18 engages a different ratchet tooth 12C as shown in FIGURE 10 to cause the counter wheel 12 to begin to rotate in the same direction as previously. During such return stroke the cam notch 18B engages the stationary stop post as indicated progressively in FIGURES 7, 9, 10, 7 in that order. To assure accurate setting or indexing of the counter wheel 12 and to lock the same in its indexed position the lever 18 is formed with an elongated transversely extending portion 18C which terminates at an end portion 18D. Between the end portions 18A, 18D there is a relieved or recessed portion within which there are three notched portions 18E, 18F, 18G. The spacing between the end portions 18A, 18D and notched portions 18E, 18F is such that as seen in FIGURE 7 each engages a different adjacent ratchet tooth 12C to

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assure a positive indexing of the counter wheel 12 to assure maintenance of its proper orientation for accurate visual indication and printing. Also when the actuating pulse is of too short duration or otherwise to fully advance the counter wheel from an initial numerical position to the next numerical position, the transversely extending portion 18C and particularly portion 18D return the wheel to such initial numerical position instead of allowing it to remain in a false intermediate position.

SUPPORTING FRAME CONSTRUCTION

The individual decade counter structures 10 are mounted in a single common supporting structure 110 using a pair of fastening screws 116 (FIGURES 1 and 2) which extend through apertured portions of the frame front panel 117 for each decade unit 10 together with a transversely extending pin 118 (FIGURE 3) which passes through aligned apertured portions 56 in each unit 10, such pin 118 also passing through aligned apertured portions of the frame side walls 120, 122 and releasably secured thereon, these frame side walls 120, 122 being, of course, stationarily secured to the frame front panel 117. It will thus be seen that it is a relatively easy matter to replace one of the counter units 10 and this is accomplished simply by removing its fastening screws 116 and releasing and withdrawing the pin 118 sufficiently to free the pin 118 of the unit apertured portion 56. A new unit 10 may then be replaced using a pair of fastening screws 116 and by a procedure which involves passing the pin 118 through the unit apertured portion 56 and securing such pin 118 to the frame side walls. For this latter purpose the pin 118 may be an elongated screw that extends between the side walls and has a nut threaded on one end of the pin 118.

The frame side walls or plates 120, 122 may be secured to the front panel 117 using, for example, four fastening screws 124 (FIGURE 1) which extend through the front panel 117 and which extend also through in-turned ends of the side plates 120, 122, one of such sidewall in-turned ends being illustrated at 120A in FIGURE 2. These side walls or plates 120, 122 are secured rearwardly to a generally U-shaped frame member 128 upon which the multicontact electrical plug 114 is mounted. This frame member 128 mounts an insulated terminal board 130 upon which a series of binding posts or terminals 132 are mounted for convenient soldering of electrical components such as, for example, resistances R and diodes D. Various circuit arrangements may be thus employed to interconnect the various terminals 1-13 (FIGURE 7) of each decade unit to a corresponding contact pin of plug 114. As previously indicated, the front panel 117 is provided with an apertured portion 117A covered by a glass window 112 so that a particular number on the counter wheel 10 aligned with the apertured portion 117A is visible as indicated in FIGURE 2.

The window glass 112 has its ends slidably mounted in a pair of stationary guides 136, 138, which are secured to front panel 117, the glass 112 being urged upwardly in its guides by coil compression springs 140 as illustrated in FIGURES 2 and 6. The lower edge of the glass 112 is bevelled at 112A and is movable by finger pressure into engagement with a metal strip 142 formed with a serrated cutting edge 142A. Normally, as shown in FIGURE 2, the glass 112 is spaced from the serrated cutting edge 142A and forms an opening through which paper P from a paper roll S is fed during the printing operation described later.

The paper roll S is supported on a rod 144 which releasably extends between the spaced frame walls 120, 122. The frame is provided with a paper guide slot 147 which comprises a pair of parallel spaced plates 146, 148 which have their ends stationarily mounted on the frame side plates 120, 122. The upper plate 146 may serve also as a temporary support for the individual units 10 during the process of securing such units within the frame.

PAPER FEEDING AND PRINTING MECHANISM

As indicated previously, the paper extends from the supply roll S through the paper guide slot 147 and out through the opening 150 at the front panel 117. It will be seen that the paper P thus extends below the series of counter wheels 12 each having ten raised numerals 0-9 at its periphery. A frame member 154 which carries eight adjustable pressure pads 156 (FIGURES 2, 12 and 16) for cooperation with a corresponding one of the eight-number wheels 12 is pivotally mounted about the axis of a shaft 158 having its opposite ends rotatably supported in the frame end plates 120, 122. This frame member 154 which is generally U-shaped in that it has two parallel extending leg portions 154A, 154B, may be pivoted about the axis of shaft 158 using an electromagnet 160, the electromagnet 160 being secured by screws 162 to the frame side wall 122. The armature 164, shown in its unattracted position in FIGURE 2, has one end of a link 166 pin-connected thereto, the other end of the link 166 being illustrated as being pin-connected by means of pin 168 to a crank portion 154C of frame 154. The frame 154 is urged to its normal position shown in FIGURE 2 by a bowed leaf spring 170 having one of its ends secured to frame 154 by screw 172 and the other one of its ends engaging a stationary post 174 secured to the side wall 120. Thus this leaf spring 170 serves also as a means for normally maintaining the electromagnet armature 164 in its extended unattracted position shown in FIGURE 2.

It is also observed that the shaft 158 mounts a pair of rubber rimmed paper feeding rollers 180, 182, the rubber rim in each case being a form of an O-ring 180A, 182A recessed in a cylindrical metal portion. These O-rings 180A, 182A contact the underside of the paper P, the paper P being sandwiched between the O-rings and corresponding ones of two cantilever supported strips 184 which provide sufficient resiliency to maintain the wheels 180, 182 in driving relationship to the paper P. Means are provided to produce rotation of shaft 158 and the rubber rimmed wheels 180, 182 thereon only during the return movement of the armature 164, i.e., the paper P is advanced immediately after a printing operation during the time that the frame 154 descends from its printing position shown in FIGURE 14. For that purpose a pair of one-way automatic clutch elements 186, 187 are provided, each of such clutch elements is in the form of a block of plastic material pivotally mounted on a corresponding frame leg 154A, 154B about the axis of pins 154C, 154D respectively and each being urged by a corresponding spring 190, 192 against the corresponding O-ring 180A, 182A. It will be seen that when the frame 154 is pivoted upwardly in FIGURE 13 about the axis of the shaft 158, there is no coupling between the clutch elements 186, 187 and the corresponding O-rings 180A, 182A and thus the frame 154 may be moved upwardly to its extreme position shown in FIGURES 14 and 16 without producing rotation of the rubber rimmed wheels 180, 182 which remain effective to maintain the paper P in a stationary position. However, when the actuating electromagnet 160 is deenergized and the frame 154 is allowed to return to its downward position under the influence of spring 170, the clutch elements 186, 187 interact with the O-rings 180A, 182A to automatically wedge themselves between the axes of aligned pins 154C, 154D and the corresponding O-ring to thereby produce an automatic coupling of frame 154 to the paper engaging wheels 180, 182 whereupon continued movement of the frame 154 downwardly causes the paper P to be advanced and moved through the opening 150, such paper movement being sufficient to move that portion of the paper with the numerals last printed thereon to move through such opening 150 and thus be visible. Any time when it is desired to separate the printed paper from its web, the glass window 112 may be pressed downwardly by finger pressure to cause the paper to be clamped between the bevelled glass 112A and the

cutting element 142. This procedure facilitates a subsequent accurate tearing of the paper.

To assure a good printing action at each of the eight counter units 12, in spite of misalignment which might exist, the individual pressure pads 156 of resilient material are adjusted using the arrangement illustrated in FIGURE 16 wherein the pad 156 of resilient material may be adjusted in frame 154 by adjustment of the Allen type screw 190 in the threaded portion 192 of frame 154. It will be seen that the adjustment of screw 190 and resulting positioning of pressure pad 156, adjusts the printing contact pressure exerted between the raised numerals of counter wheel 12 on the paper P and thus different degrees of pressure may be obtained so as to assure even printing at each of the eight printing stations.

OVER-ALL OPERATION

Assuming that the paper P from roll S is fed into the position illustrated in FIGURE 2 and that each of the eight decade counters 12 is mounted in position, the individual wheels of each counter are rotated incremental distances corresponding to one numeral upon each current pulse applied to the corresponding electromagnet 34, there being, of course, one electromagnet 34 per decade unit 12. The count at any time may be observed through the window 112 as indicated by the count 2 1 4 3 6 5 8 7 in FIGURE 1. This identical count appears on raised numerals on the counter wheels, such raised numerals at that time being the ones closest to the printing frame 154 in FIGURE 2. This count may be printed on paper P by supplying a current pulse to electromagnet 160 in which case the printing frame 154 with the eight printing pads 156 mounted thereon is moved progressively upwardly as indicated in FIGURES 13, 14 and 16 to produce a printing of such count on the pressure sensitive paper P. During the return movement of the frame 154 the clutch elements 186, 187 automatically engage the paper drive wheels 180, 182 to advance that portion of the paper with the count thus recorded thereon through the opening 150 to allow the same to be visible and be compared with the count visible through the window 112. This same count may be transmitted to a remote location over interconnecting wires since each one of the printing counters 10 includes brush elements 22A, 22B (FIGURES 19 and 20) for making electrical contact between, on the one hand, the central sector 11A and, on the other hand, one of the ten sectors 1A-10A to thereby provide information with respect to the position of the counter wheel 12. The individual sectors 1A-10A are connected through components mounted on circuit board 130 (FIGURE 3) to pins on the multicontact plug 114 whereby such information provided by the particular position of brush 22 may be conveyed in an electrical sense to a remote location.

The particular construction of the brush 22 is of importance in assuring long life and suitable contact with commutator segments under vibration, inertia forces and other adverse conditions. An important feature of the construction is that two pairs of bifurcated portions 22A, 22B are provided and these are of unequal or different lengths so as to not be naturally resonant at the same frequency whereby reliability is increased. Using two fingers there is no switching hence arcing of electrical currents carried by such fingers due to bounce, vibration, etc.

Further, preferably each contact leaf is rounded as, for example, by forming a dimple portion at the region where contact is made with a commutator segment.

Preferably the Allen type adjusting screws 190 in FIGURE 16 are of the self-locking type to secure an adjustment.

Preferably, as seen in FIGURE 2, the plunger 164 has an internal threaded portion 164A into which one end of link 166 is adjustably threaded with a lock nut 167 to secure the adjustment. This adjustment permits the adjustment of the force applied to printer frame 154 by adjustment of the duration of the contact time of pin 168

in lost motion slot 166B in link 166. The overtravel provided by lost motion slot 166B has other advantages, notably, it allows the printer frame 154 to bounce away from the printing wheel after impact so that counting, i.e., positioning of the counter wheel by electrical pulses which may or may not be present, is not interrupted.

While the particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

We claim:

1. A decade counter unit including a pair of plates; spacer means between said plates and spacing the same apart; electromagnetic means mounted between said plates; a counter wheel having indicia thereon and rotatably supported between said plates; means operatively connected between said electromagnetic means and said wheel and effective for rotating said wheel successively equal incremental distances upon corresponding successive energization of said electromagnetic means, said electromagnetic means including a pivotally mounted armature; a first lever pivotally mounted on one of said plates and having a yoke portion embracing the free end of said armature; a second and third lever each pivotally mounted on said first lever; an element having ratchet teeth mounted on said counter wheel with said ratchet teeth being engageable by said second and third levers; spring means urging said second and third levers together; and a stationary stop means engageable with each of said second and third levers for limiting their movement in a direction away from each other.

2. A decade unit as set forth in claim 1 in which said second lever has an end portion engageable simultaneously with a plurality of said ratchet teeth.

3. A decade unit as set forth in claim 2 in which said end portion extends laterally of said second lever and is notched to conform with the shape of said plurality of ratchet teeth.

4. A decade counter unit including a pair of plates; spacer means between said plates and spacing the same apart; electromagnetic means between said plates; a counter wheel having indicia thereon and rotatably supported between said plates; means operatively connected between said electromagnetic means and said wheel and effective for rotating said wheel successively equal incremental distances upon corresponding successive energization of said electromagnetic means; said counter wheel carrying an electrical brush engageable with spaced contacts on one of said plates; said spaced contacts being located in the path of movement of said brush such that successive and different ones of said contacts are engaged and interconnected by said brush when and as said counter wheel is rotated; and said one plate being a printed circuit board having printed terminals on one end thereof, and conducting printed strips on each side thereof interconnecting said terminals with said spaced contacts which are also printed on said board.

5. A counter unit as set forth in claim 4 in which a pair of said terminals are connected to terminals of said electromagnetic means.

6. A counter unit as set forth in claim 4 in which said one plate has an apertured portion and a conductive coating in said apertured portion and electrically interconnecting printed strips on opposite sides of said board.

7. A counter unit as set forth in claim 4 in which fastening means is secured between said plates to receive an elongated releasable fastening element with its axis extending parallel with and between the planes of said plates.

8. A counter unit as set forth in claim 7 in which said plates are formed with aligned apertured portions through

which an elongated fastening element may pass with its axis extending perpendicular to the planes of said plates.

9. The combination with a plurality of counter units as set forth in claim 7, including a frame structure having a front panel and two spaced side plates connected thereto, said plurality of units being spaced side by side between said spaced side plates with planes of said counter plates and frame structure extending parallel; a plurality of said fastening elements, one for each of said units and releasably securing the said fastening means of the unit to said front panel.

10. The combination as set forth in claim 9 in which said units are formed with aligned apertured portions, a common fastening element releasably extends through said aligned portions of each of said units and also through aligned apertured portions of said spaced side walls of said frame structure.

11. The combination as set forth in claim 10 in which said front panel has an apertured portion through which indicia on each counter unit is visible.

12. The combination with a plurality of counter units as set forth in claim 4, including a frame structure having a front panel and two spaced side plates connected thereto, said plurality of units being spaced side by side in parallel relationship between said spaced side plates; said indicia on each counter wheel comprising raised printing characters; means for supporting a paper supply roll between said spaced side plates of said frame structure; said panel having a slotted portion through which paper from said roll may extend; paper guide means mounted between said supporting means and said slotted portion; paper from a roll mounted on said supporting means being capable of passing from said roll, through said guide means, adjacent to one of said raised characters of each counter unit and out through said slotted portion; a paper engaging frame movably mounted between said spaced walls for pressing said paper into contact with said raised characters.

13. The combination as set forth in claim 12 in which said paper engaging frame includes a plurality of adjustable pressure pads, one for each counter unit raised characters.

14. The combination as set forth in claim 13 in which said paper engaging frame is pivotally moved by an electromagnet mounted on one of said side walls and having a working stroke and a return stroke; paper contacting and feed means rotatably supported between said side walls; and one way clutch means between said paper engaging frame and said feed means for rotating said paper feed means only during said return stroke.

15. The combination as set forth in claim 14 in which said paper feed means includes a wheel for engaging one side of paper and resilient means mounted on said paper guide means for pressing paper against the periphery of the last-mentioned wheel.

16. The combination as set forth in claim 15 in which said one way clutch means includes a block of material pivoted on said paper frame, said block being wedged between said frame and said wheel periphery during the return stroke of said electromagnetic means.

17. A decade counter unit including a pair of plates; spacer means between said plates and spacing the same apart; electromagnetic means between said plates; a counter wheel having indicia thereon and rotatably supported between said plates; means operatively connected between said electromagnetic means and said wheel and effective for rotating said wheel successively equal incremental distances upon corresponding successive energization of said electromagnetic means; said counter wheel carrying an electrical brush engageable with spaced contacts on one of said plates; said spaced contacts being located in the path of movement of said brush such that successive and different ones of said contacts are engaged and interconnected by said brush when and as said

counter wheel is rotated; and said brush including a bifurcated element having the ends of two cantilever portions thereof engageable with the same one of said contacts.

18. A counter unit as set forth in claim 17 in which said brush includes an additional bifurcated element having the ends of two cantilever portions thereof engageable with a contact which is different from said one contact, said one contact and said different contact being bridged by said brush, said additional element being longer than the first-mentioned bifurcated element and having a different mechanical resonant frequency.

19. A decade counter unit comprising: a frame; an energizable magnet mounted to said frame; a counter wheel having indicia thereon and rotatably supported on said frame; a pivotally mounted armature attracted by said magnet upon energization thereof; spring means urging said armature to its de-energization position; lever means operatively connected between said armature and said wheel effective for rotating said wheel successively equal incremental distances upon corresponding successive energization of said magnet; ratchet teeth carried by said wheel; said lever means including first and second pawl means engageable with different ones of said ratchet teeth; said first pawl means cooperating with said ratchet teeth to rotate said wheel substantially one-half of an incremental distance upon energization of said magnet; and said second pawl means cooperating with said ratchet teeth to rotate said wheel the remainder of said incremental distance after de-energization of said magnet.

20. A decade counter unit as set forth in claim 19 wherein said lever means includes first, second and third levers; said first lever being pivotally mounted to said frame and having a yoke portion embracing the free end of said armature; said second and third levers carrying said first and second pawl means, respectively, and being pivotally mounted to said first lever.

21. A decade counter unit comprising: electromagnetic means; a rotatably mounted counter wheel having a plurality of indicia characters thereon; means operatively

connected between said electromagnetic means and said wheel and effective for rotating said wheel successively equal incremental distances upon corresponding successive energization of said electromagnetic means; a plate adjacent to said wheel; a central contact on said plate adjacent to said wheel; a plurality of spaced readout contacts on said plate arranged in a generally circular pattern around said central contact, said readout contacts being equal in number to the number of said indicia characters; and said wheel carrying an electrical brush including a pair of spaced fingers with one finger engaging said central contact and the other finger being engageable with said readout contacts.

22. A decade counter unit as set forth in claim 21 wherein said plate is a printed circuit board having printed terminals on one end thereof, said central and readout contacts being printed on said board, and conducting-printing strips on each side of said board interconnecting said terminals with said contacts.

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U.S. Cl. X.R.

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