United States Patent [19]

Ditman

[11] **3,771,442**

[45] **Nov. 13, 1973**

[54] **ZERO-LOCK PRINT WHEEL APPARATUS**

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[22] Filed: **Jan. 11, 1972**

[21] Appl. No.: **216,931**

[52] **U.S. Cl.** ..... **101/99,** 101/95, 101/93 C

[51] **Int. Cl.** **B41j 1/28**

[58] **Field of Search** ..... 235/144 PN, 58; 178/23, 34; 101/93 C, 95, 99, 110

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[57] **ABSTRACT**

An electromechanical apparatus for imprinting a six digit number on a charge receipt. Six geared print wheels are rotatably mounted on a common shaft and each wheel associates with an electromagnet activated camming arm. For each impulse of an electromagnet, the associated print wheel is rotated about its axis for one-tenth of a turn. A zero-lock mechanism is provided so that upon the activation of the print wheel electromagnets for a predetermined number of times without the activation of a zero-lock electromagnet, each print wheel is positively reset to zero. The print wheels are restrained against movement in the absence of an activating pulse to the print wheel electromagnets.

17 Claims, 6 Drawing Figures

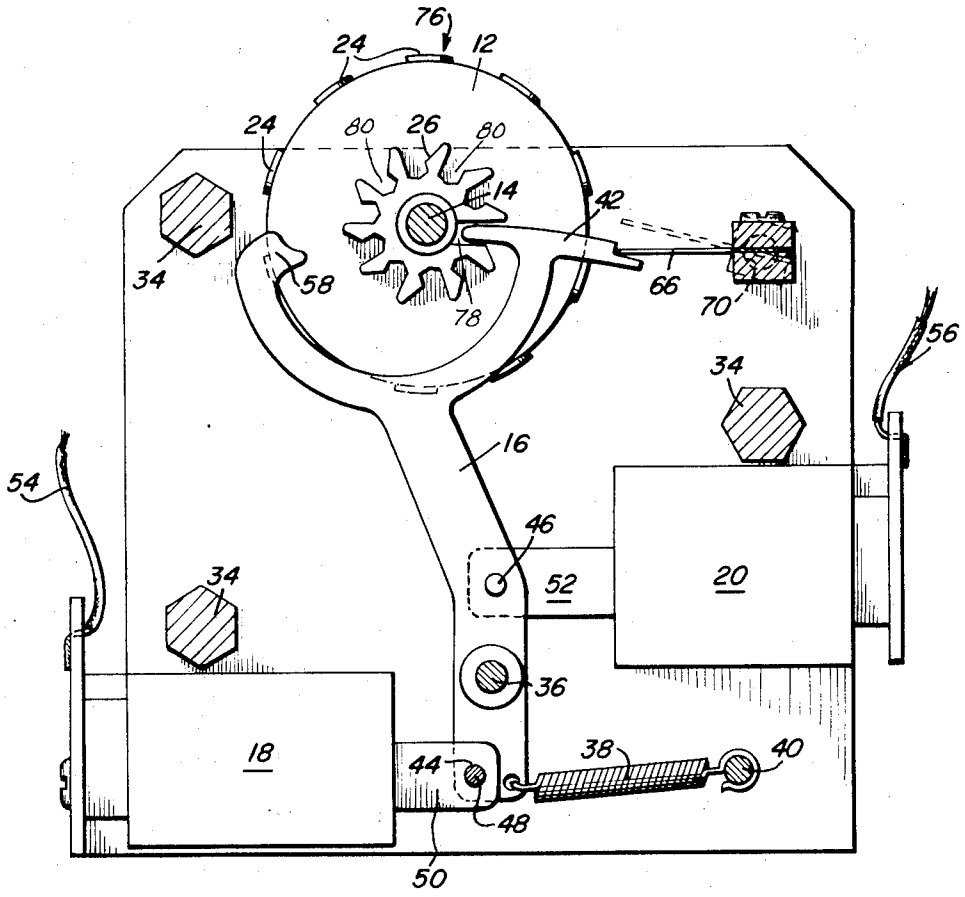


Fig. 1

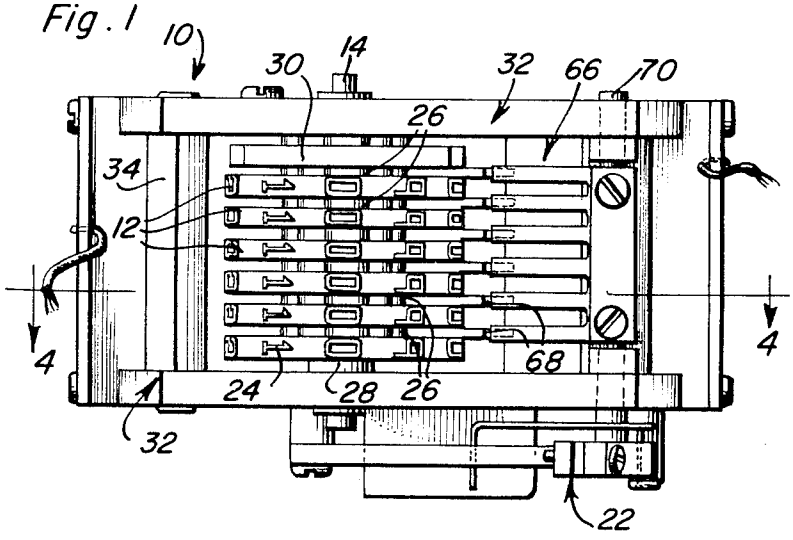


Fig. 2

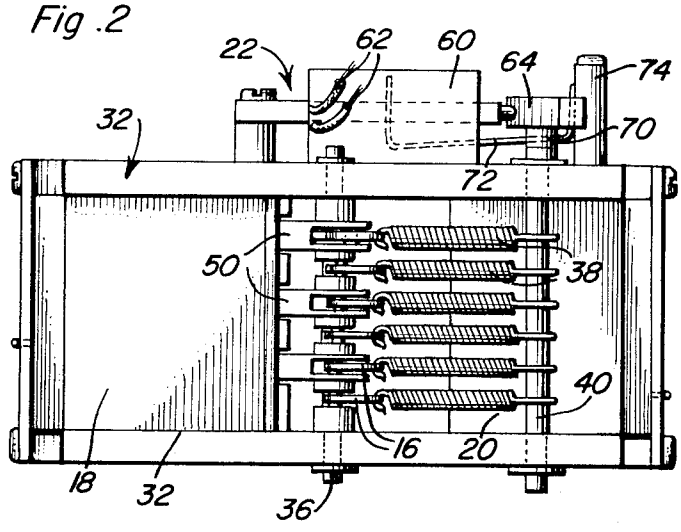


Fig. 3

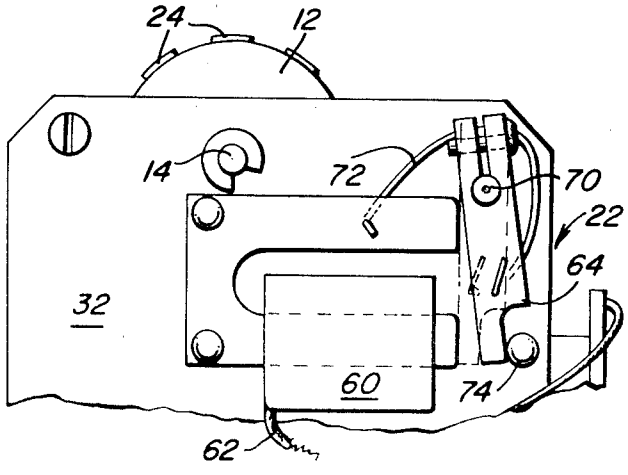


Fig. 4

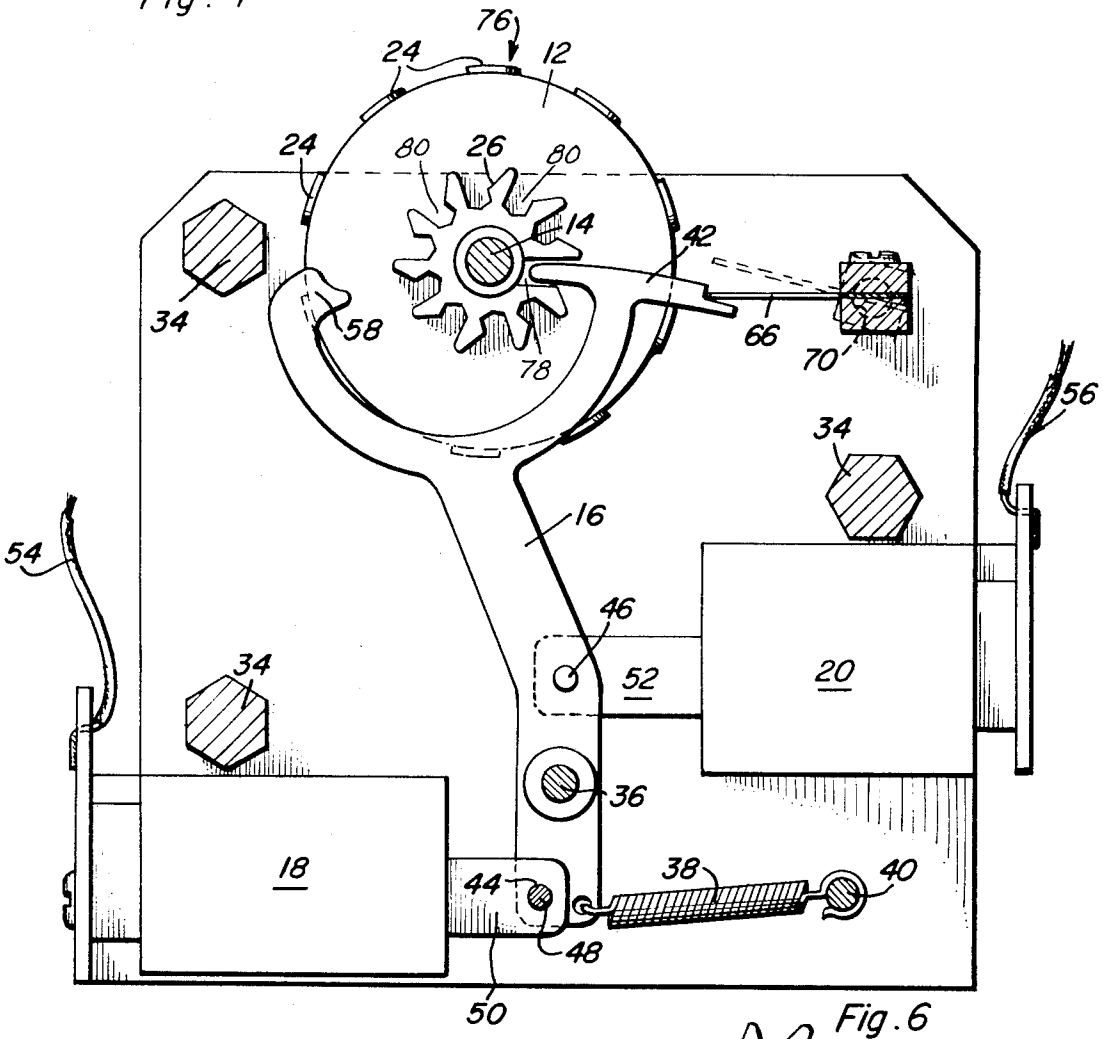


Fig. 5

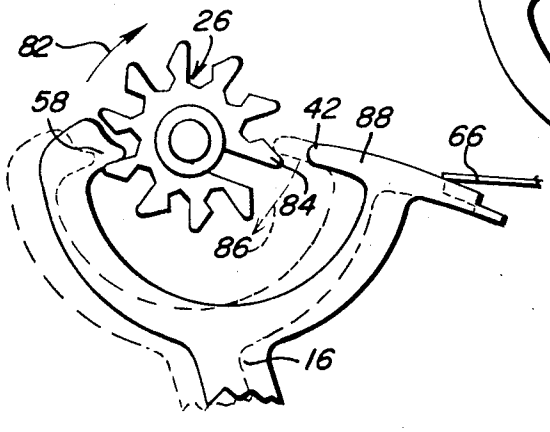
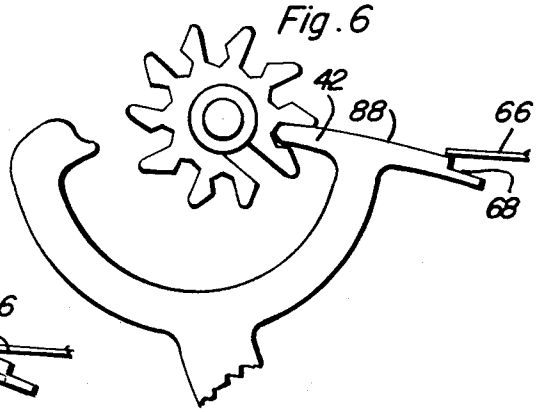


Fig. 6



ZERO-LOCK PRINT WHEEL APPARATUS

BACKGROUND OF THE INVENTION

In a specific application, this invention is directed to the field of imprinting a customer's charge receipt by means of an electronic credit terminal. There are numerous applications for devices which imprint numbers or other characters on charge receipts or the like, and there are at least an equal number of devices for carrying out this task. But the known imprinting devices have many drawbacks.

Some of the known imprinting devices are purely mechanical, requiring that the number to be imprinted be manually set by an operator. In others, there is the existing problem that the print wheels, once set, may be reset by accidental contact of one kind or another. In most known devices, it is necessary to ensure that the print wheels are reset to zero after each imprinting operation, with this resetting to zero usually being carried out manually or by means of special circuitry. And in all known devices of this type, there exists the problem that it is difficult to ensure that the print wheels are in fact reset to zero after each imprint operation. Many other disadvantages exist.

It is toward the elimination of the above-noted drawbacks of the prior art, that the present invention is directed.

SUMMARY OF THE INVENTION

The present invention relates to an electromechanical apparatus especially adapted for use in an electronic credit terminal, for imprinting the dollar amount of a purchase on a customer's charge receipt. The inventive apparatus is operated by electrical impulses, is protected against unintentional changes of the imprint setting, and is quickly and accurately reset to zero after each imprinting operation without the necessity for special and complex zero reset components.

In one specific embodiment of the present invention, six print wheels carrying the numbers 0 through 9 on their peripheries are aligned side-by-side and share a common axis of rotation. Integral with each print wheel is a specially designed gear arrangement adapted to be activated by an electromagnetically controlled camming arm. Six electromagnets, arranged in two sections of three each, control the operation of the respective print wheels. The camming arms lock the print wheels in place at all times except when the respective electromagnets are activated.

A combined release and zero-lock electromagnet simultaneously controls the operation of six leaf spring elements, with each of the leaf spring elements serving to associate with one of the camming arms. With the release and zero-lock electromagnet in its rest position, and with the respective print wheels set to zero, each camming arm associates with a special deep stop in its associated gear, and in this position, the respective leaf springs lock the camming arms into the deep stops. Then, only upon the simultaneous activation of the zero-lock electromagnet and the print wheel electromagnets are the camming arms released by the leaf springs, again allowing the activated print wheels to rotate. The print wheels may then be rotated with the zero-lock electromagnet at rest, until again reaching their zero setting, at which time they are again locked in place. After the imprinting of a customer's charge receipt, each of the print wheel electromagnets is pulsed at least nine times with the zero-lock electromagnet at rest, and hence it is thus ensured that each print wheel returns to its zero position.

Accordingly, it is the main object of the present invention to provide a simple, economical and relieable electromechanical print wheel apparatus whose setting cannot be accidentally changed and which can quickly and accurately be reset to zero.

These and other objects of the present invention, as well as many of the attendant advantages thereof, will become more readily apparent when reference is made to the following description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top elevation of the zero-lock print wheel apparatus forming a part of the present invention;

FIG. 2 is a bottom view of the print wheel apparatus illustrated in FIG. 1;

FIG. 3 is a side view of the print wheel apparatus illustrated in FIG. 1;

FIG. 4 is a cross-section of the zero-lock print wheel apparatus taken along line 4—4 of FIG. 1;

FIG. 5 is an enlarged view of one print wheel gear and its associated camming arm and leaf spring during one stage of operation; and

FIG. 6 is a view similar to FIG. 5, showing a further stage of operation.

DETAILED DESCRIPTION OF THE DRAWINGS

With reference first to FIGS. 1 through 4, the construction of the inventive zero-lock print wheel apparatus will be described. The inventive apparatus is shown generally at 10 and comprises, basically, six print wheels 12 arranged side-by-side and rotatably mounted on a common shaft 14, six camming arms 16, two solenoid banks 18 and 20 of three print wheel electromagnets each, and a zero-lock mechanism shown generally at 22. Each of the print wheels 12 is provided with a set of raised characters 24 representing the numbers 0 through 9, and each is integral with a driving gear 26 concentric with the shaft 14. Spacers 28 and 30 maintain the print wheels 12 in their proper orientations on the shaft 14 between two main casing plates 32.

The six camming arms 16 are pivotally mounted about a common shaft 36 and are biased, by means of a plurality of coil springs 38, toward a rigid post 40. The respective camming arms 16 are biased so that while at rest, the locking noses 42 thereof lie between adjacent teeth in the gear 26. (See FIGS. 4 and 6).

Each of the camming arms 16 is provided with two small openings 44 and 46 located on opposite sides of the pivot shaft 36. The camming arm 16 illustrated in FIG. 4 associates, through opening 44 and by means of a pin 48, with a plunger 50 from one of the electromagnets in the solenoid bank 18. The preceding and the succeeding camming arms 16 associate with the respective plungers 52 from the solenoid bank 20. That is, the camming arms 16 alternate between the print wheel electromagnets in the solenoid banks 18 and 20. While this arrangement of alternate connection is used to conserve space, it should be appreciated that a single solenoid bank could be provided with six electromagnets associating with the respective camming arms 16 through either one of the openings 44 or 46.

The electrical connections to the electromagnets in solenoid bank 18 are shown generally at 54, and the

electrical connections to the electromagnets in solenoid bank 20 are shown generally at 56. Each of the print wheel electromagnets is connected so that when activated, its respective plunger 50 or 52 is drawn inwardly, so as to act upon its associated camming arm 16 to urge the driving nose 58 thereof toward the gear 26 as shown in FIG. 5 and in a manner which will be more fully explained below. Then, upon the relaxation of the print wheel electromagnet, the coil spring 38 returns the camming arm 16 to the position illustrated in FIGS. 4 and 6.

Now, the structure of the zero-lock mechanism will be described. The zero-lock mechanism 22 comprises, basically, a zero-lock electromagnet 60 activated through electrical connections 62, a pivotable arm 64, a leaf spring mounted on a shaft 70 and controlled by the arm 64, and a stop 68 on the rear of each locking nose 42. The arm 64 is controlled by the electromagnet 60 and is mounted on the outside of the plate 32. The shaft 70 extends through and is supported by the plates 32, serving to mount the leaf spring array 66 between the plates 32 and in association with the stops 68 in the camming arms. When the zero-lock electromagnet 60 is in its rest position, the arm 64 is biased by means of a spring 72 against a limiting pin 74. The leaf spring array 66 is therefore biased in the rest position shown in solid lines in FIG. 4. When, however, the zero-lock electromagnet is activated, the arm 64 is drawn into the position shown in phantom in FIG. 3, moving the leaf spring array 66 into the position shown in phantom in FIG. 4. The operation of the zero-lock mechanism 22 will be explained below.

With the elements of the inventive zero-lock print wheel apparatus in the positions illustrated in FIG. 4, the number zero is located where represented generally at 76. When so arranged, the locking nose 42 of the camming arm 16 rests within a deep locking stop in the gear 26. As seen best in FIGS. 4, 5 and 6, the stop 78 is deeper than the remaining gear spaces which are indicated at 80.

Where the locking nose 42 lies in the deep stop 78 of the gear 26, as shown in FIG. 4, the leaf spring array 66 is biased toward and lies in the available stops 68 in the respective locking noses. The elements are then locked in place and can be moved only upon the simultaneous activation of the zero-lock electromagnet 60 and one or more of the print wheel electromagnets in the banks 18 and 20. Such simultaneous activation retracts the leaf spring array 66 from the stops 68 in the locking noses 42 and at the same time pivots one or more of the camming arms 16 about the shaft 36 and into the position illustrated in FIG. 5. The activation of a print wheel electromagnet in one of the solenoid banks 18 and 20 alone, or the activation of the zero-lock electromagnet 60 alone, has no effect upon the movement of a print wheel 12. Only upon the occurrence of the simultaneous activation described above does a print wheel rotate.

With reference now to FIGS. 5 and 6, the driving of a print wheel 12 will be described.

By activating the zero-lock electromagnet 60, the leaf spring array 66 is moved into the position shown in phantom in FIG. 4. With the simultaneous activation of a print wheel electromagnet, one of the plungers 50 or 52 drives a camming arm 16 from the position illustrated in FIG. 4 into the position illustrated in FIG. 5. The driving nose 58 acts on the gear 26 as illustrated in FIG. 5 and rotates the gear in the direction of arrow 82. Such action rotates the print wheel through 18°. At the completion of the stroke of the plunger 50, the camming arm 16 is biased by a coil spring 38 from the position illustrated in solid lines in FIG. 5 to that illustrated in phantom. The locking nose 42 then acts on gear tooth 84 and rotates the gear 26 with its integral print wheel 12 through an additional 18° angle in the direction of arrow 86. Ultimately, the elements take the relative positions shown in FIG. 6.

It will be noted when comparing FIGS. 4, 5 and 6, that the leaf spring array 66 falls into the available stops 68 of the respective locking noses 42 only when the locking noses rest within the deep stops 78 in the gears 26. At all other times, the leaf spring array 66 rides along the top surfaces 88 of the locking noses 42. In this manner, upon the simultaneous activation of the zero-lock electromagnet and one or more of the print wheel electromagnets, the leaf spring array 66 is prevented from falling into the stop 68 in the respective camming arm. Only when the locking nose 42 again associates with the deep stop 78 does the leaf spring 66 fall into the stop 68.

The above-described operation makes possible the rapid and accurate reset to zero of the present invention. Once the elements have moved out of the FIG. 4 position and into the position illustrated in FIG. 5, it becomes necessary to ensure zero reset before the next imprint operation. Such zero reset is brought about by the continued activation of each print wheel electromagnet for a minimum of nine cycles. In this manner, each print wheel rotates until the elements of the apparatus again reach the positions illustrated in FIG. 4, at which time all elements are locked in place, and all print wheels are set to zero. During the reset operation, the zero-lock electromagnet remains idle.

With the inventive zero-lock print wheel apparatus described above, the drawbacks of the prior art devices are eliminated. As it is necessary to simultaneously activate the zero-lock electromagnet and one or more of the print wheel electromagnets to rotate the respective print wheels 12, accidental rotation becomes unlikely, and a setting of zero is ensured. Once a number setting is effected, and when the respective print wheel electromagnets are again at rest, the locking noses associate with the respective gears so that the print wheels are again locked against accidental rotation. The inventive apparatus requires no human setting, and the apparatus is adapted for rapid and accurate reset to zero. After merely pulsing the print wheel electromagnets a minimum of nine times without the simultaneous activation of the zero-lock electromagnet, reset to zero is accomplished. Then, the apparatus is ready for the next numerical setting, accomplished simply by the simultaneous activation of the zero-lock electromagnet and one or more of the print wheel electromagnets. For example, if the number "312" were to be set, the last three print wheel electromagnets would be pulsed once with the zero-set electromagnet, the first and the last of these would again be pulsed, and the first would even once again be pulsed. Reset is accomplished by pulsing all print wheel electromagnets a minimum of nine times.

Above, a specific embodiment of the present invention has been described for the purposes of illustration only and that numerous alterations and modifications may be practiced by those skilled in the art without de-

parting from the spirit and scope of the invention. Accordingly, it is the intent that the invention not be limited by the above, but be limited only as defined in the appended claims.

What is claimed is:

1. An electromechanical apparatus especially suited for printing, the apparatus comprising: a housing; a plurality of printing wheels mounted on a common shaft for rotation with respect to said housing; gear means connected to each of said wheels for controlling the rotation of its respective wheel; a plurality of camming arms movably mounted in said housing, each camming arm movable into operative relationship with one of said gear means to rotate the printing wheel connected thereto; a plurality of driving electromagnets, each electromagnet in operative relationship with and, when activated, adapted to move one of said camming arms, thereby causing the rotation of the associated printing wheel; a plurality of first locking means for maintaining each of said wheels in any one of a number of predetermined positions by limiting the movement of the associated gear means; and second locking means for preventing said first locking means from allowing movement of the associated gear means when the associated wheel is in a particular one of said number of predetermined positions.

2. The electromechanical apparatus recited in claim 1, wherein each gear is integral and concentric with its associated wheel; and wherein each camming arm acts directly on its associated gear means to drive its associated wheel.

3. The electromechanical apparatus recited in claim 1, wherein each of said camming arms is integral with an associated first locking means.

4. The electromechanical apparatus recited in claim 1, wherein each of said first locking means is normally biased into locking engagement with its associated gear means.

5. The electromechanical apparatus recited in claim 1, wherein each of said gear means has a single deep stop provided therein; and wherein each of said deep stops is adapted to receive a projection on said first locking means when the associated wheel is in said particular one of said number of predetermined positions.

6. The electromechanical apparatus recited in claim 1, wherein each of said gear means has a deep stop provided therein; and further wherein a projection on each of said first locking means engages said deep stop when the associated wheel is in said particular one of said number of predetermined positions.

7. The electromechanical apparatus recited in claim 1, wherein said second locking means is prevented from limiting the movement of said first locking means when the associated wheels are in other than said particular one of said number of predetermined positions.

8. The electromechanical apparatus recited in claim 1, wherein each of said gear means is integral with and concentric with its associated wheel; wherein each of said camming arms is pivotally mounted in said housing and provided with a driving surface for engaging its associated gear means; wherein each of said first locking means is biased towards its associated gear and includes a projection for meshing with its associated gear; wherein each of said gear means is provided with a single deep stop adapted to receive the projection of its associated first locking means when its associated wheel is in said particular one of said number of predetermined positions; and wherein said second locking means, when engaged prevents said projection of the associated first locking means from moving out of the deep stop of its associated gear means.

9. The electromechanical apparatus recited in claim 1, wherein each of said wheels is provided with a set of raised numbers arranged about its periphery.

10. The electromechanical apparatus recited in claim 1, further including means for moving said second locking means out of operable relationship with said first locking means, said apparatus further characterized in that said printing wheel can rotate from said particular one of said number of predetermined positions only upon the simultaneous activation of the associated camming arm and said means for moving said second locking means.

11. The electromechanical apparatus recited in claim 1, wherein each of said first locking means includes a first end adapted to be received between adjacent teeth of the associated gear means and a second end spaced from said first end and having an abutting surface thereon.

12. The electromechanical apparatus recited in claim 11, wherein said second locking means includes a movable stop adapted to be placed into and out of abutting relationship with said abutting surface of at least one of said first locking means.

13. The electromechanical apparatus recited in claim 12, wherein said first and second ends of said first locking means are adapted to move away from said gear means and towards the second locking means when the movement-limiting action of said second locking means is inactive.

14. The electromechanical apparatus recited in claim 13, wherein each of said gear means includes a deep stop for receiving the first end of the associated first locking means; and further wherein the movable stop of said second locking means can be placed into abutting relationship with the abutting surface of the first locking means only when its first end is received in said deep stop.

15. The electromechanical apparatus recited in claim 14, wherein said movable stop comprises a leaf spring array.

16. The electromechanical apparatus recited in claim 1, wherein said second locking means includes a leaf spring array which, when engaged, limits the movement of each of said first locking means.

17. The electromechanical apparatus recited in claim 1, wherein each of said camming arms and its associated first locking means are carried on a pivotally mounted U-shaped member, the arms of which are each adapted to mesh with their associated gear means and an arm of which is adapted to associate with said second locking means.

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