PLURAL COLUMN CHANGEABLE DISPLAY MECHANISM

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ABSTRACT

g.1 A plural column display device or register wherein at least a pair of lower and higher order column rotors have extending thereacross respective lower and higher order tapes which carry suitable indicia and are shiftable by their associated rotors for presentation of indicia at a display location. A cyclic drive means is operatively connected to the lower order rotor and a normally inactive drive transfer means is interposed between adjacent order rotors for drive transmission to the next higher order responsive to a preselected pattern of control associated with the lower order column.

3 Claims, 8 Drawing Figures
PLURAL COLUMN CHANGEABLE DISPLAY MECHANISM

BACKGROUND OF THE INVENTION

The instant disclosure relates to a character display mechanism in which the characters to be displayed are generally numeric and which due to their function, must be relatively large in size and still not require that the display box in which the display is packaged be excessively large.

It is more specially related to display devices in which more than one order of numeric information is displayed, such as from the number 10 through any higher order such as 99 or 999. The invention relates to new, simplified, and improved methods of advancing the characters a character at a time, together with a new and improved control system for advancing the next higher order character during the time that a tens carry is required to the higher order, such as going from a 9 display to a 10 display or 29 to a 30 display, etc. Although many display devices in the counter field are available and known today, the majority of these displays use either small size characters or use characters which are formed by the combining of the stroke elements of the character which form the character. In a display in which the characters are distributed on a wheel or a disc, the discs or wheels become very large when the individual characters to be displayed are of a large size, such as 2-inch, 2½-inch or 3-inch high characters. As a result, the overall size of the unit to package a mechanism with discs or wheels large enough to handle characters of this size, becomes relatively large. In counters and other displays which utilize wheels or discs, advancing the next higher order wheel or disc as described above when a tens carry occurs is accomplished with Geneva mechanisms, with cam controlled auxiliary drive mechanisms, or with auxiliary power input systems such as additional solenoids. In the decimal system in which 10 characters are distributed around a wheel, one-tenth of a revolution of the higher order wheel resulting from a tens carry occurs for a specific one-tenth movement of the lower order wheel for each revolution of the lower order wheel. The mechanisms for accomplishing this one-tenth movement of the higher order wheel therefore require many auxiliary parts.

SUMMARY OF THE INVENTION

As a result, it is a main object of this invention to provide a character display mechanism which can utilize large characters, but still does not require that the package mechanism be extremely large in size.

It is another object of this invention to provide a large character display mechanism which is cyclic in nature such that a simplified higher order advance mechanism can be utilized.

It is another object of this invention to provide a large character display mechanism in which it is impossible to assemble the mechanism if the displayed character is out of registration with the cyclic advance mechanism.

It is another object of this invention to provide a cyclic digital display mechanism which due to its simplicity of construction and reduced number of parts is extremely reliable.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, which will be exemplified in the construction hereinafter described, and of which the scope will be indicated by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side sectional elevation of the mechanism at the section taken basically on line 1—1 of FIG. 2.

FIG. 2 is a top view of the mechanism showing the character display and the relationship of the size of the character to the size of the overall package.

FIG. 3 is a partial sectional view substantially along line 3—3 of FIG. 2 and shows the components associated with the tens carry advance mechanism with the parts shown in the nonadvancing position.

FIG. 4 is a partial sectional view substantially along lines 3—3 of FIG. 2 which shows the components associated with the tens carry advance mechanism with the parts shown in the 10 advancing position.

FIG. 5 is a partial sectional view substantially along the line 5—5 of FIG. 4 or line 5—5 of FIG. 6 showing the end view of the tens carry advance mechanism.

FIG. 6 is a partial sectional view substantially along line 6—6 of FIG. 4 which shows the top view of the components used for tens carry advance mechanism.

FIG. 7 is a partial plan view illustrating a tape construction in accordance with the teachings of the present invention.

FIG. 8 is a partial perspective view showing a slightly modified embodiment of drive transfer means.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIG. 2, the characters 200 to be displayed are painted, silk screened, printed or photographed on a flexible ribbon, strip or tape 210, for the units order display and on a second flexible ribbon, strip or tape 210A for the tens order display. The tapes may be endless and of any desired length. As shown in FIG. 1, the tape 210 can be routed back on itself several times in several areas thus enabling a long length tape required for 10 large characters, numerals or other suitable indicia to be packaged in a relatively small area. Since the space required for this routing or folding of the tape back on itself is small even for long lengths of the tape, it is obvious that the character size can be increased at will to provide a character of the size required for the final display and still not require the case to grow excessively. As shown in FIG. 1, the tape 210 wraps around a lower order axially rotatable rotor or drive drum 211, which has in one or more positions sprocket teeth 212, 212A, FIG. 1 and 2. The sprocket teeth 212 are used to control the position of the tape with respect to the input cyclic drive 250 and the cyclic control involved with advancing the tape to the next position. The sprocket teeth 212 are integral with and a component part of the drive drum 211. The drive drum 211 is used to support the tape over its full width and the friction between the drum surface and the tape, drives the tape for advancing it to the next position.
position. The sprocket teeth therefore are for the positive positioning and not the drive. The drive drum 211 is positioned in the case 201 such that the tangent line of the tape as it leaves the drum is in the plane required for the viewing of the tape at desired display stations, say through windows 202 of cover case 201.

As mentioned above, the sprocket teeth 212 and 212A can be designed such that the pitch and location of each annular series or set of teeth 212 and 212A are an exact size and have a definite relationship. Since the tape is driven by friction between the tape drum 211 and the tape 210, and since the sprocket teeth 212 are used primarily to assure the correct positioning of the tape with respect to the cyclic operation of the sprocket drum 211, a single set of sprocket teeth 212 is all that is basically required. If the tape 210 is excessively wide, it may be desirable to incorporate a second set of sprocket teeth such as 212A, to further insure that the tape is held in correct position with the tape drum 211. Since the tape 210 contains several sprocket holes which are associated with any one character, it is important that the correct hole is aligned with the correct sprocket tooth 212 of the sprocket drum 211. This correct alignment is required so that the character 200 is centrally positioned at the display station in a window 202 when the cyclic mechanism 250 and the sprocket drum 211 are in their stopped position. In order to assure that the correct sprocket hole is located with the correct sprocket teeth 212, the tape 210 is designed such that one set of sprocket holes and associated sprocket teeth 212 on the drum 211 are made with one pitch dimension or tooth spacing and the other set of sprocket holes and sprocket teeth 212A are designed with a different pitch dimension or tooth spacing. Thus, only at definite positions will two sprocket holes be in alignment on the tape and on the drum. As shown in FIG. 7, the tape 210 is designed such that the upper sprocket holes which engage the sprocket teeth 212, have a pitch between sprocket holes of 0.1875 inches. If one character on the tape utilizes a character to character pitch distance of 16 sprocket holes at a center distance of 0.1875 inches, the pitch distance between the characters is 3 inches. The lower set of sprocket holes in FIG. 7 which engage with sprocket teeth 212A are designed with a pitch distance of 0.150 inches. Since the number of teeth 212 and 212A on the sprocket drum must be a whole number of teeth, the number of teeth 212A at a 0.150-inch pitch in the 3-inch pitch distance required to match the 16 teeth at 0.1875 inches spacing between characters, must be 20 sprocket teeth. As shown in FIG. 7, if the first holes related to sprocket teeth 212 and 212A are in alignment, no other sprocket holes are in alignment until the fifth hole. As a result, it can be seen that it is impossible to install the tape 210 with the sprocket drum 211 in such a manner that the tape is out of registration a short distance from where it should be located, since the holes will not line up with the sprocket teeth. It is to be understood that the specific number of teeth and length of spacing as just described are for explanation purposes and that many other combinations are possible to achieve the same effect. The particular combination just described allows the tape to be installed appropriately a quarter of a number or indicia character 200 out of registration, which amount is easily detectable. It is possible to define a number of teeth at a given pitch for one set of sprocket holes and a corresponding different number of teeth at a different pitch for the other set of sprocket holes, such that the product of the number of holes times the pitch between the holes for each case equals a given value, at one unique combination. If this value is used as the pitch between characters and the tape were manufactured in this manner, it would be possible to install the tape only in one position of the complete circumference of the sprocket drum. In most applications, the timing related to the advancing of the higher order wheel has a definite relationship with the cyclic position of the lower order character, and in many applications the cyclic position of the sprocket drum relate to switch closures, cam operation, shutter operations, etc., the correct positioning of the tape on the drum is very important. As a result, the technique of providing two different quantities of sprocket holes on the tape with different pitch distances assures the correct registration of the tape with respect to the sprocket drum, since the tape only fits onto the drum at definite positions.

The foregoing description of the units or lower order column is also generally applicable to the adjacent tens, or higher order column. That is, the tens or higher order column includes an axially rotatable rotor or drum 211A, which is suitably mounted for rotation adjacent to and coaxially with the lower order rotor or drum 211. The higher order drum or rotor 211A may be provided at spaced locations about its periphery with sets of radially outwardly projecting sprocket teeth, which sets are of different spacing or pitch, in the same manner as described hereinbefore in connection with projections or teeth 212 and 212A. Also, the higher order column may include an elongate flexible ribbon, strip or tape 210A extending across the higher order rotor 211 and past the display station defined by window 202. The higher order tape may be endless, and provided with indicia of suitable type, such as a numerical character 200, see FIG. 2. Thus, the tens or higher order column is generally similar to the units or lower order column, as thus far described.

As has been mentioned above, in the decimal system when the lower order tape 210 advances from a 9 position to a 0 position as in the conventional tens carry operation, the higher order tape 210A advances one position. The components shown in detail in FIGS. 3, 4, 5 and 6 show a simplified mechanism for advancing the higher order tape 250. As shown in FIG. 2, 6 and 7, the lower order tape 210 has a hole or opening 220 in such a position that when the display character 9 is registered in the window 202, a pin or radially extensible sensing member 221 on a block 222 passes into the hole 220. When any other number is registered in the window, the pin 221 in FIG. 3 is not allowed to move into the extended position as occurs when a 9 is registered in the window since there is no hole in the tape at these other positions. The hole 220 is elongated with respect to the size of the pin 221 so that tolerance variations will not hinder the pin 221 from entering the hole 220, when in its engaging position. Since the hole 220 and the sprocket holes, which engage the teeth 212 and 212A of the sprocket drum 211, are perforated in the tape at the time of manufacture, the relationship of these holes to the character printed on the tape for dis-
play in the window, cannot get out of phase. The pin 221 and block 222 are shown in the raised position FIG. 4, as occurs when the hole 220 lines up with the pin 221. A compression spring 223 is mounted in such a manner that it tends to move slide block 222 into its displaced position as shown in FIG. 4, the sensing member or pin 221 thus being resiliently urged outward. The spring 223 is mounted and retained in its operating position by a pin 224 securely fastened or made integral with the sprocket drum 211. The upper end of fixed pin 224 fits into a hole 225 diametrically opposite the pin 221 in such a manner that the hole 225 and the fixed pin 224 guide the movement of the lower end of block 222 while the pin 221 operates in another hole, guides the upper end of block 222. As a result, when the hole 220 in the tape 210 is in alignment with the pin 221, the spring 223 is in its extended position holding the block 222 in its position where the pin 221 passes into the hole 220. The extent of the outwards movement of the block 222 and pin 221 is controlled by internal surface 226 of the sprocket drum 211. Spring 223 therefore holds the block 222 against this stop surface 226 when the hole 220 is in line with pin 221. The sprocket drum 211 is mounted for rotational movement on a shaft 227. This shaft 227 not only passes through the sprocket drum 211, but also passes through an elongated hole 228, FIG. 5 of block 222.

As shown in FIG. 3, the tape 210 is positioned with respect to the cyclic operation of the sprocket drum 211 in the position in which any other number except 9 is registered in the window, such that hole 220 of tape 210 does not fall in alignment with the pin 221. As a result, the pin 221 is depressed to a position as shown in FIG. 3, in which case the spring 223 is compressed. In order to assure that there is sufficient tension in the tape 210 to move the pin 221 and block 222 to the retracted position and compress spring 223 at all times when a hole 220 is not in operating position, the tape is routed around guide rollers 240 in FIG. 1 in such a manner that the path established by the rollers 240 is equal to the circumferential length of the tape 210. Since all components produced have tolerance, an adjustable shaft 241, FIG. 1, is provided. This shaft 241 is adjusted to compensate for these tolerances, plus provide the additional tension in the tape that is required.

As previously described, the pin 221 is depressed for each number on the tape when it is registered in the window or on display, except when the number 9 is in the window. If the display mechanism is a subtractive unit, the hole 220 is in line with the pin 221 when the number 0 is registered in the window.

The higher order sprocket drum 211A is provided on its end adjacent to the lower order sprocket drum 211, with a projection or engagement member 230, FIG. 3. The block 222 is provided in the same plane with pin 221 with a second pin or engagement member 229, which lies outside of the body of the lower order sprocket drum 211. When the tape 210 holds the pin 221 and the block 222 in its inward or retracted position, FIG. 3, the pin 229 is located inward a distance sufficient to allow a clearance or space 232 to exist between the upper end of the pin 229 and the lower surface of the projection 230. In this position, the lower order sprocket drum 211 turns freely without introducing movement to the higher order sprocket drum 211A.

As shown in FIG. 1, the tape 210 wraps approximately 180 degrees around the sprocket drum 211, as a result, it only retains the pin 221 and the block 222 in its depressed position for a portion of a revolution, about 180°. The portion of the revolution that the pin 221 is held depressed is determined by this tape mounting configuration. Since the projection 230 on the higher order sprocket drum 211A occupies a relatively short radial distance in comparison to the amount of wrap that the tape has around the sprocket drum, movement of the pin 221 during that portion of the revolution does not effect the higher order sprocket drum 211A.

In the particular arrangement just described, the sprocket drum 211 makes one complete revolution (360°) for each character advance and the sprocket drums 211 and 211A must always stop at the same angular position for each character advance in order for the characters 200 to be correctly aligned in the window 202. In order to assure that the drum 211 always stops at the same angular position for each advance, a single cycle clutch, a single cycle motor or any of the many single cycle mechanisms 250, FIG. 1, can be used to provide this single cycle revolution to the lower order sprocket drum 211. As shown in FIG. 6, the pin or engagement member 229 stops just adjacent to the driving surface of the projection 230 when the lower order sprocket drum 211 is in its home or stopped position. As a result, when the lower order sprocket drum 211 turns a revolution when the pin 221 is in the hole 220 and the pin 229 is in interference engagement with the projection 230, the higher order sprocket drum 211A rotates the same angular movement as the lower order sprocket drum 211. At the time when this cyclic movement is completed, the pin 221 will be opposite the portion of the tape on which the hole 220 is not in registration; as a result, when the tape 210 depresses the pin 221 during the later part of the cycle, the pin 229 is moved from driving engagement with the projection 230. The friction between the driven projection 230 and the driving pin 229 can be designed such that the sliding motion required to separate the pin 229 from the projection 230, cannot be accomplished while the driving load is on the projection 230. As a result, the pin 221 and the block 222 cannot be depressed by the tension in the tape until the sprocket drum 211 has come to its home position thus relieving the friction force between the pin 229 and the projection surface 230. This disengaging position is angularly adjustable with respect to the wrap of the tape 210 on the sprocket drum 211 to provide for accurate stopping. If the advance speed is excessively high or if the mechanism must withstand considerable vibration, the sprocket drums 211 and 211A could be provided with a detent follower which would locate and detent the sprocket in home position.

In order to aid in the separation of the pin 221 from the projection 230, the driving surface of the pin 229 are tapered in such a manner that the depression of the pin immediately generates a gap between the driving surface of the pin 229 and the projection 230 as shown in FIG. 5. This type of tapering of the components being called a negative wedge angle to provide ease of disengaging.

It will therefore be seen that the engagement members 229 and 230 cooperate to define a normally inac-
tive or disengaged drive transfer means interconnected between the lower and higher order rotors 211 and 211A. Activation of the interrotor drive transfer means 229, 230 is controlled by the tape 210, and specifically by the tape formation or opening 220. Thus, the tape formation 220 defines control means for controlling the activation of the drive transfer means 229, 230. The control means 220 serves its intended function by its registry with sensing means or pin 221, the latter sensing this registry and passing through the opening 220.

As was previously described, the control means or hole 220 of tape 210 is located with respect to number 9 to effect an additive display, or with respect to the number 0 to effect a subtractive display. If the display device of the present invention is to be capable of both additive and subtractive movement of the tape, see FIG. 8, two different control holes 220 may be located on the tape along different longitudinal axes or lines and each positioned in correct relation with the respective character 0 or 9. As seen in FIG. 8, there may be two separately movable blocks 222 and 222', provided with respective sensing means or pins 221 and 221', which sensing pins are displaced from each other laterally of the tape so that each pin engages only in its respective hole 220 of the tape. The drive pin 229 of block 222 serves to effect additive display and will be displaced as shown in FIG. 5, while the additional drive pin 229' of the additional movable block 222' is positioned on the opposite side of the engagement member 230 as pin 229 for effecting displacement of the engagement member in the opposite direction as pin 229. That is, for effecting an additive display, the additive pin or radially movable engagement member 229 rotates the nonradially movable engagement member 230 in one direction, and the subtractive pin or radially movable engagement member 229' rotates the nonradially movable engagement member 230 in the opposite direction.

As a result from the above description, it can be seen that a simplified method of providing positive registration of a long length tape capable of containing many large characters can be constructed so that a simplified single cycle drive mechanism can be used which will advance not only a lower order tape display, but higher order tape positions requiring movements due to tens carry, both for additive and subtractive movements.

From the foregoing, it is seen that the present invention provides a plural column changeable display mechanism which is adapted to present relatively large indicia or characters to view, while the entire mechanism occupies relatively small space, and further fully accomplishes its intended objects.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention.

What is claimed is:

1. A plural column display mechanism comprising a lower order display station, a lower order rotor associated with the lower order display station, a lower order tape extending across said lower order rotor in driven relation therewith and through said lower order display station, said tape carrying indicia for presentation at the lower order display station, a higher order display station, a higher order rotor associated with the higher order display station, a higher order tape extending across said higher order rotor in driven relation therewith and through said higher order display station, said higher order tape carrying indicia for presentation at the higher order display station, cyclic drive means operatively connected to said lower order rotor for cyclically driving the latter, a normally inactive drive transfer means carried by said lower order rotor and activatable to interconnect said lower order rotor in drive transfer relation with said higher order rotor, control means on said lower order tape operative to activate said drive transfer means in a preselected pattern, and uniquely interfitting formations on said lower order rotor and tape, for properly relating operation of said cyclic drive and drive transfer means.

2. A plural column display mechanism according to claim 1, said interfitting formations comprising differently pitched sets of sprocket teeth on said lower order rotor, and said lower order tape having corresponding sets of sprocket holes, said sprocket teeth and holes having pitch distances which are each evenly divisible into the center-to-center distance of the associated tape indicia and defining a repeat pattern having a pitch distance which is evenly divisible into said center-to-center distance.

3. A plural column display according to claim 1, said indicia being defined by successive numeral markings on each tape from "zero" through "nine" inclusive, and said control means comprising a closed formation on said tape to normally retain said drive transfer means inactive, and an open formation on said tape to intermittently release and activate said drive transfer means and to effect the higher order tens carry.