

[54] RECORDING DEVICE

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346/60, 346/72, 346/79, 346/98

[51] Int. Cl. G01d 9/02

[58] Field of Search 346/40, 60, 61, 72, 79, 95,
346/98, 105, 106; 197/151; 73/312; 235/92
TC

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UNITED STATES PATENTS

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Primary Examiner—Joseph W. Hartary
Attorney—Claron N. White

[57]

ABSTRACT

A device for periodic recording of traffic flow on roads or of liquid level of a river by printing on paper tape the positions of a set of counter print wheels of a mechanical counter that is driven in response to vehicular traffic or to a change in liquid level. As a traffic counter the device provides automatic periodic resetting of the wheels to zero. A novel, disposable printing ribbon cartridge permits construction of the device with rigid support, by spaced vertical plates secured to each other and a base plate, of both ends of the counter as well as of an assembly of print rolls to improve printing while avoiding threading of the ink ribbon. A corelator-locking mechanism of the device fixes position of the wheels during printing. A one-piece counter wheel, with a pawl mounted in it for resetting to zero, provides more rigid faces for the decagonal periphery.

20 Claims, 30 Drawing Figures

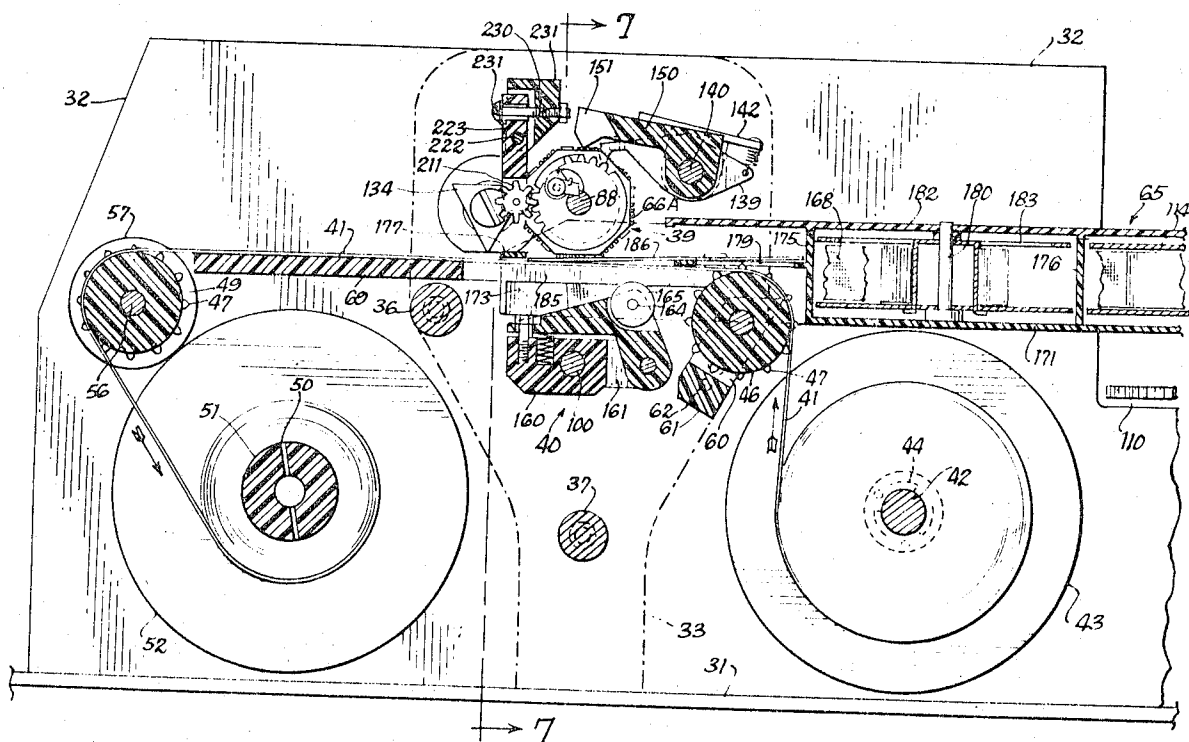


FIG. 4

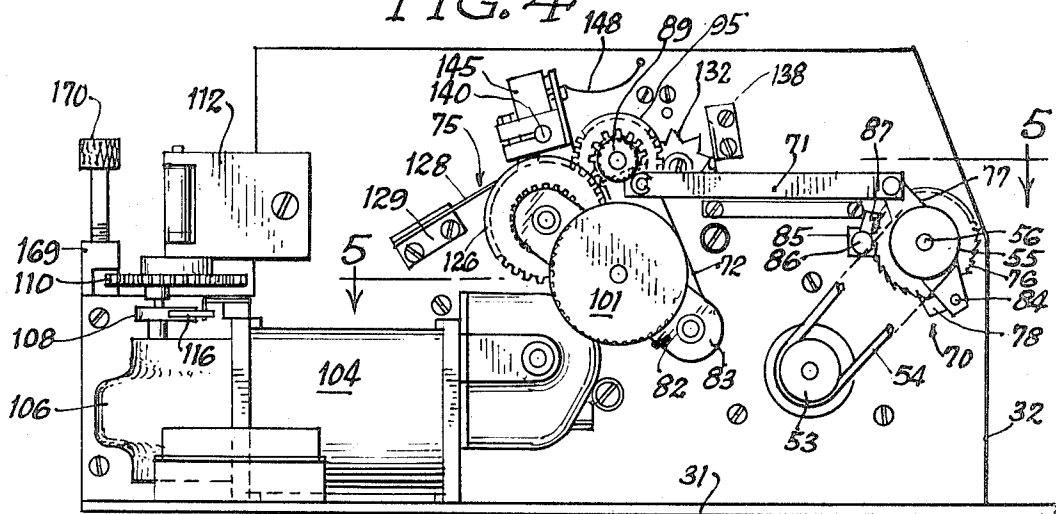
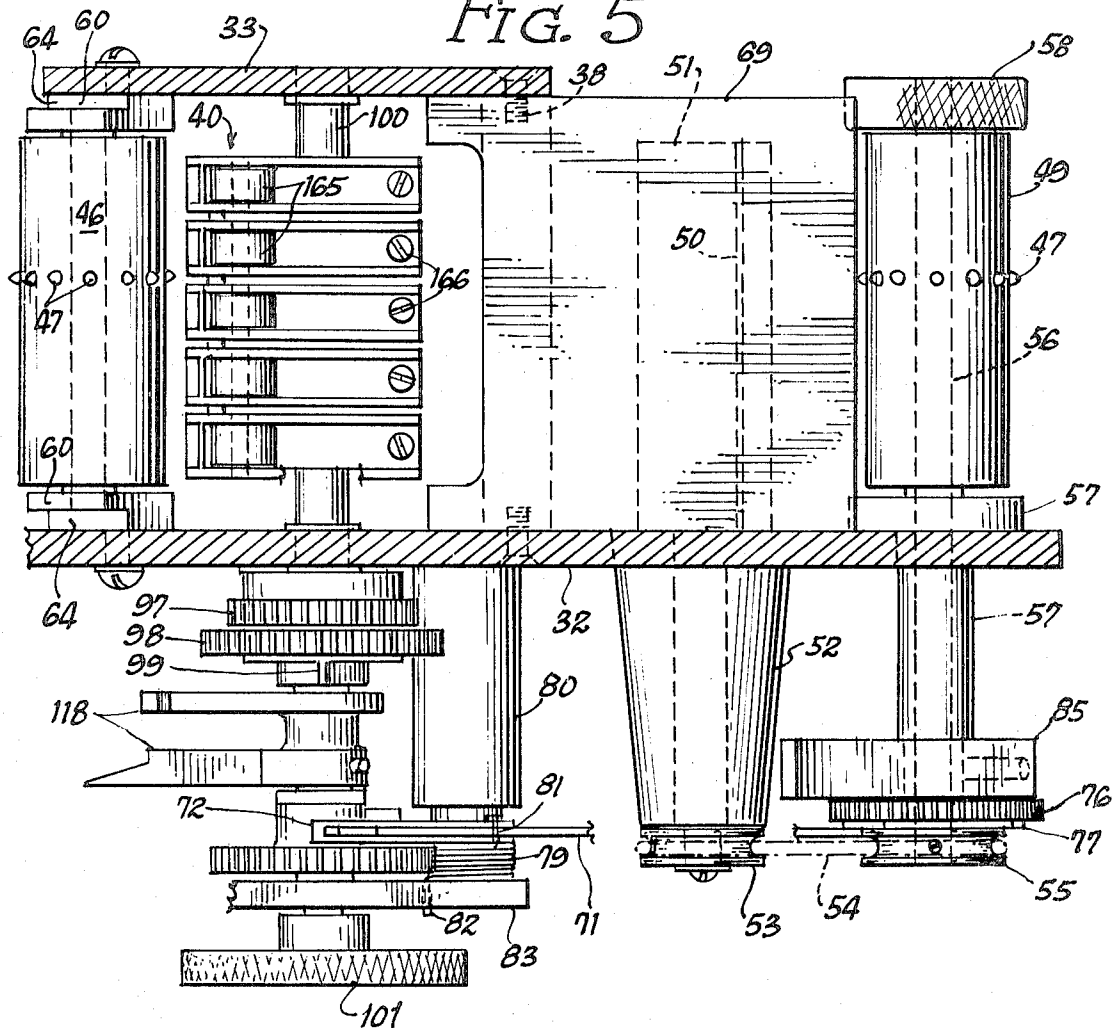


FIG. 5



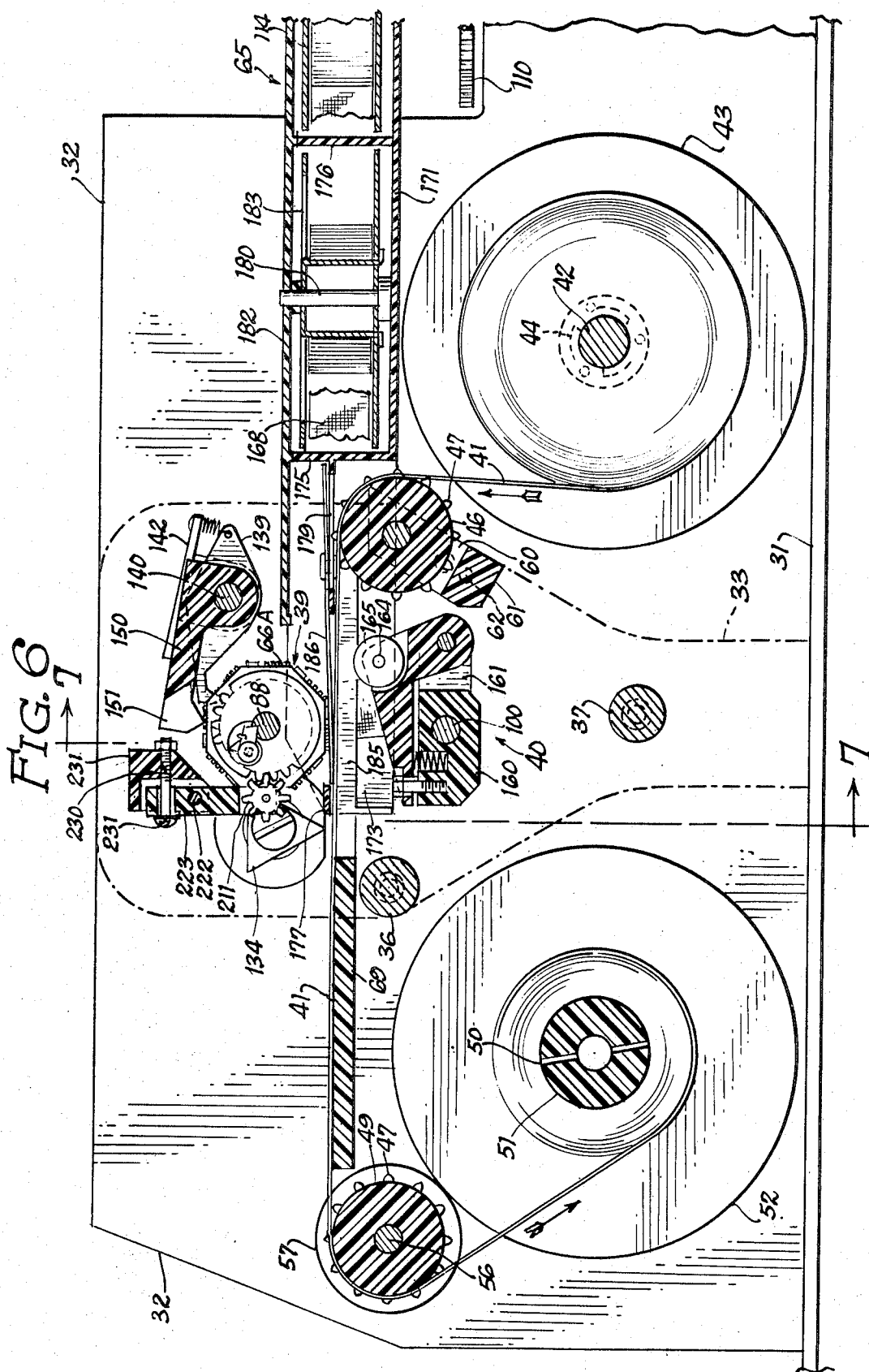


FIG. 7

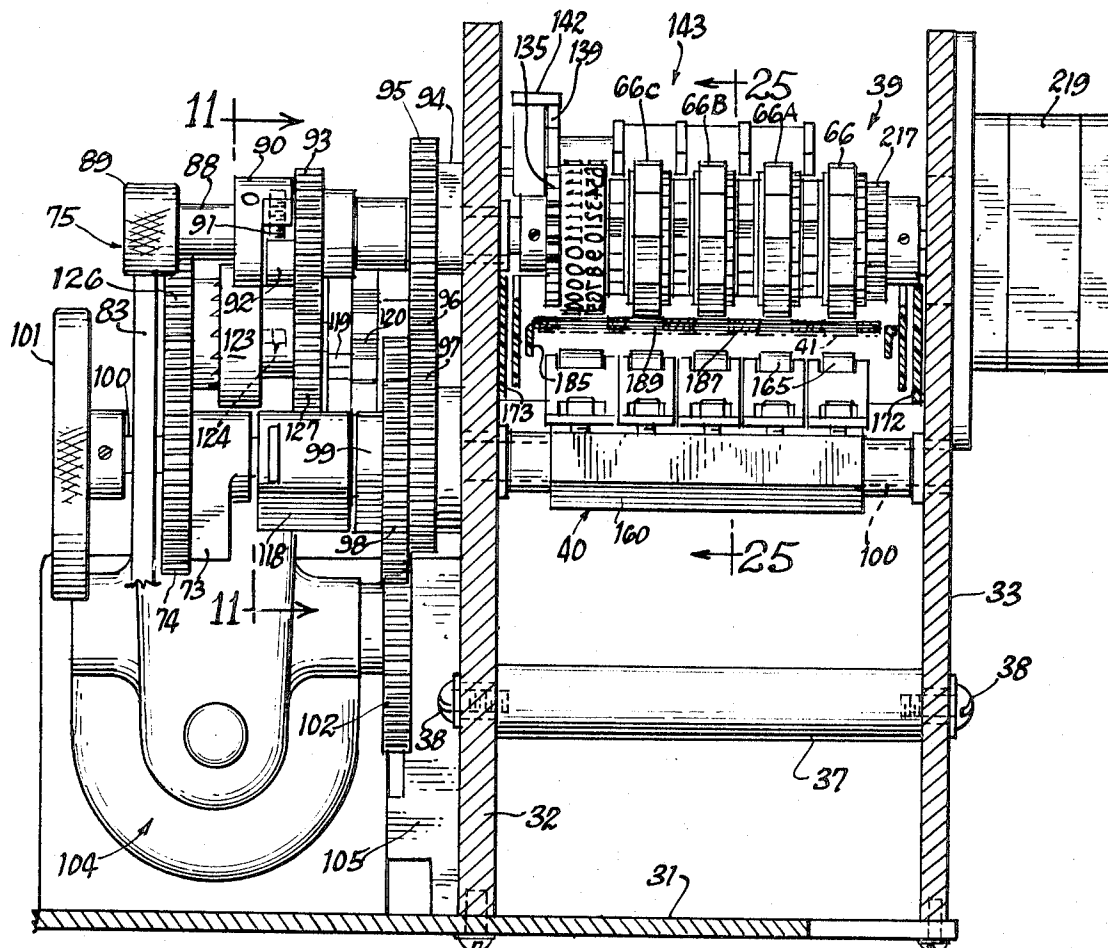


FIG. 8

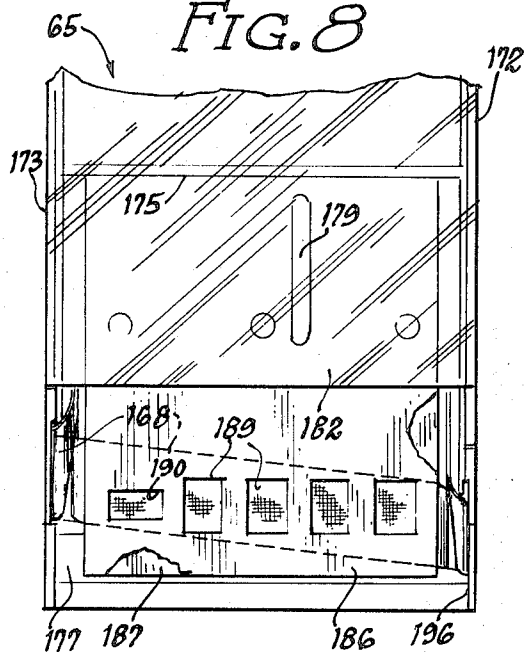


FIG. 9

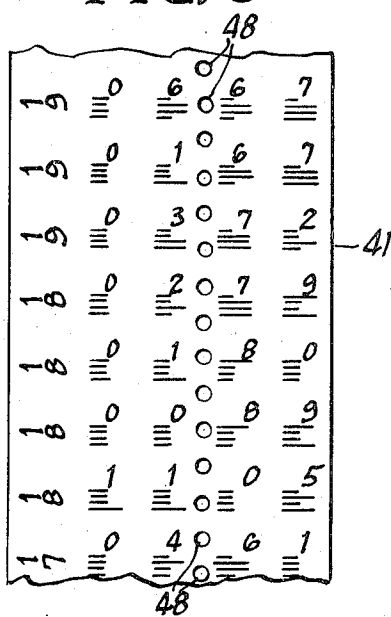


FIG 10

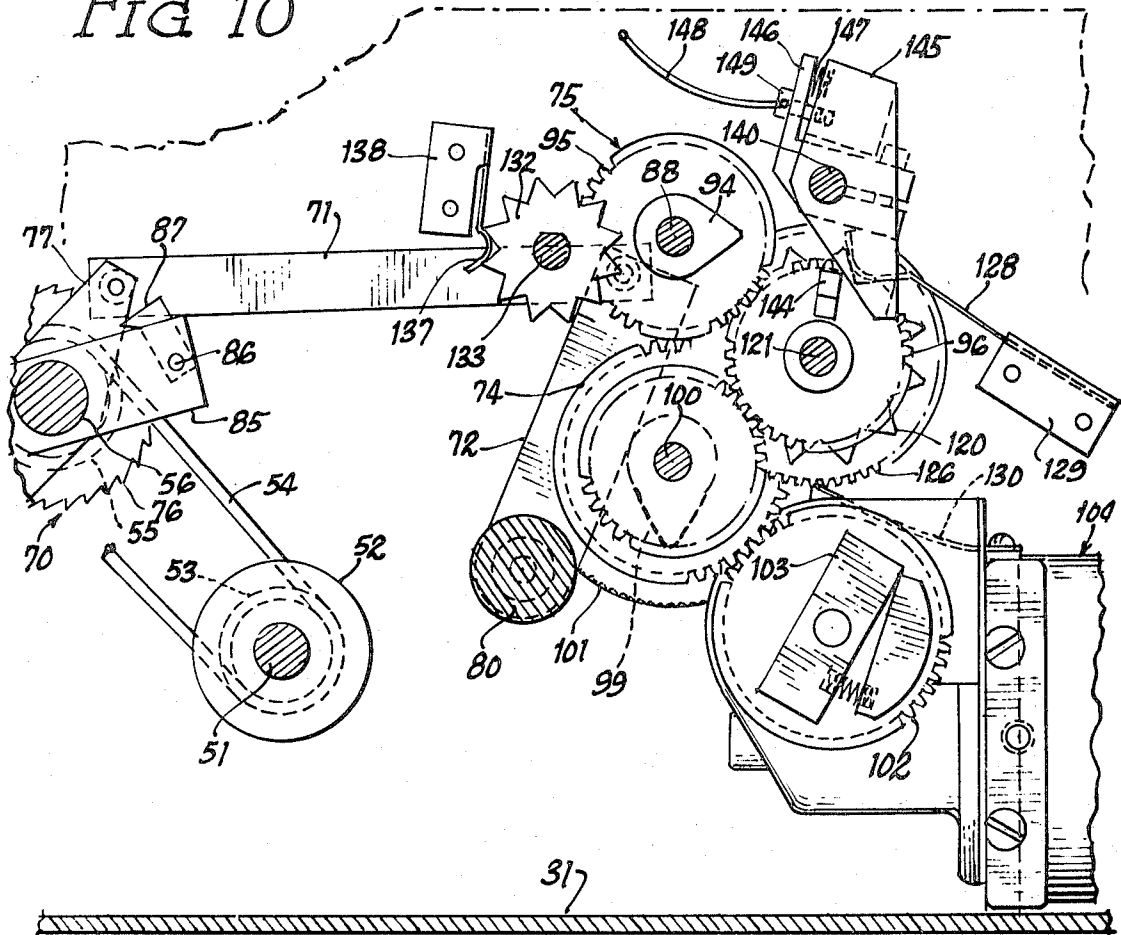


FIG. 11

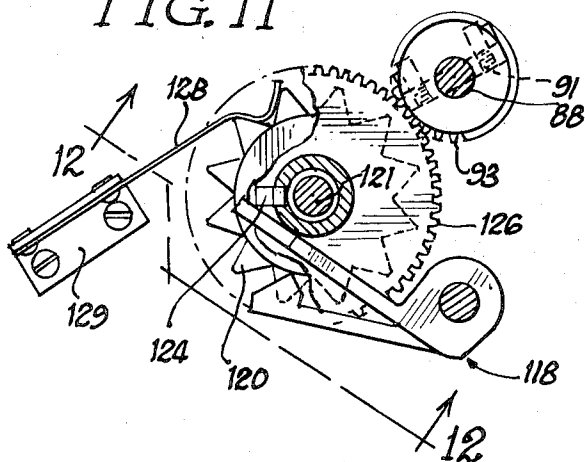


FIG. 12

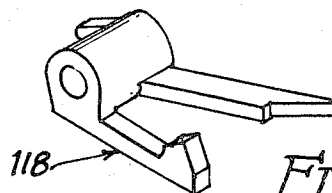
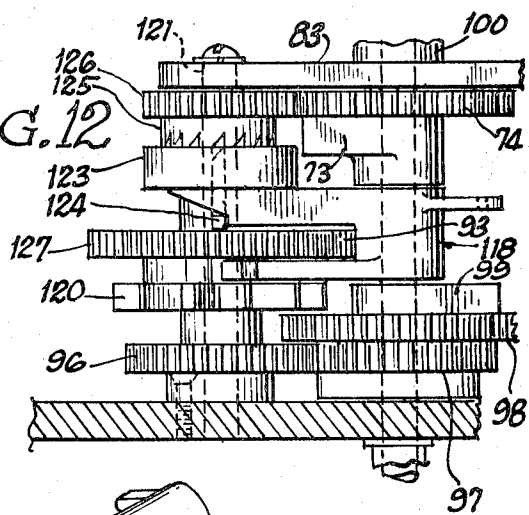


FIG. 13

FIG. 14

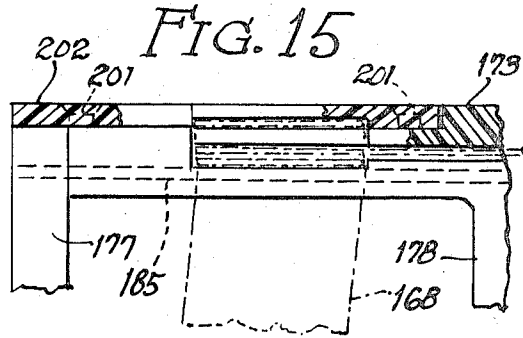
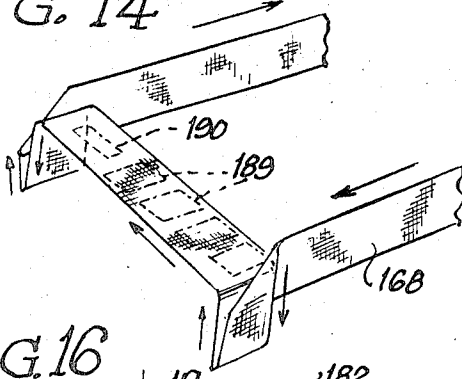


FIG. 16

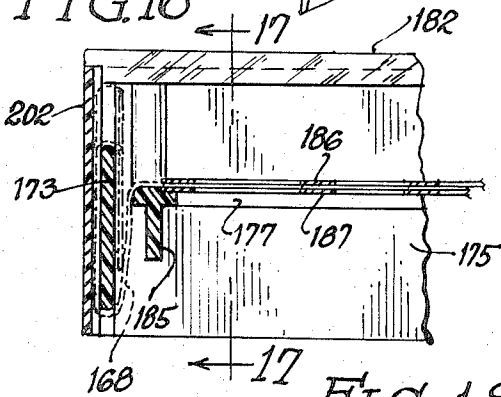


FIG. 17

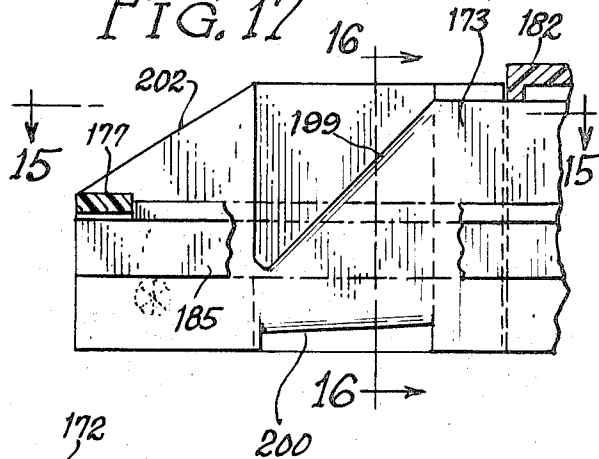


FIG. 18

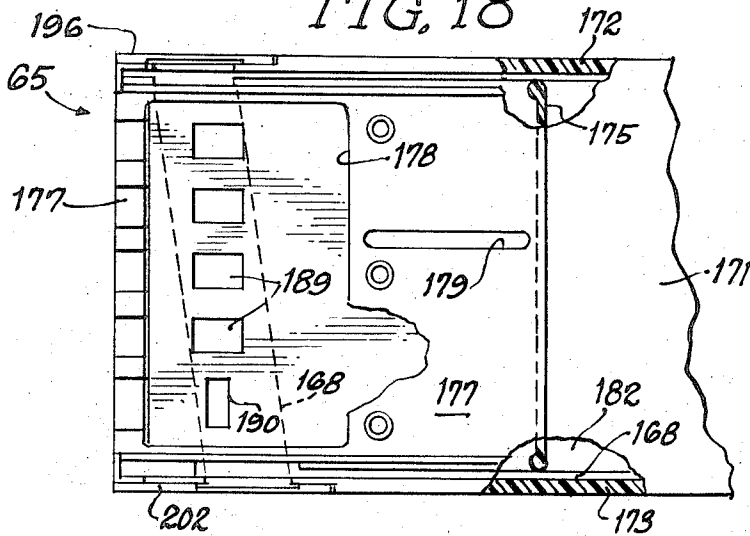


FIG. 19

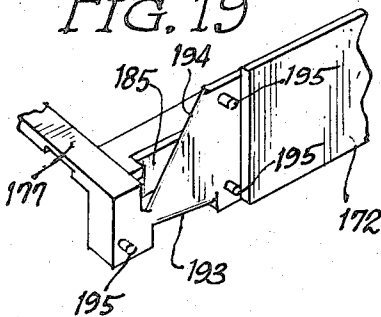


FIG. 20

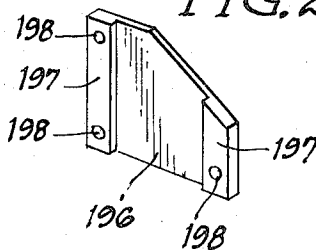


FIG. 21

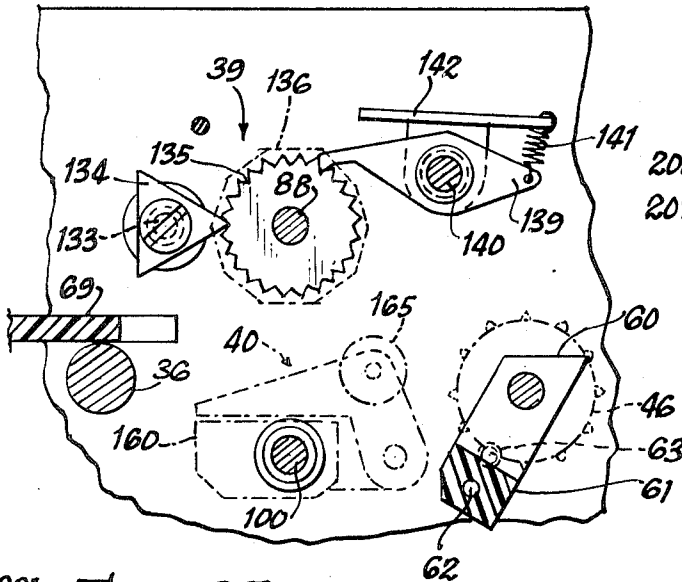


FIG. 22

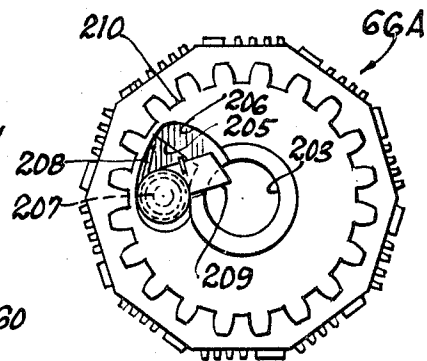


FIG. 23

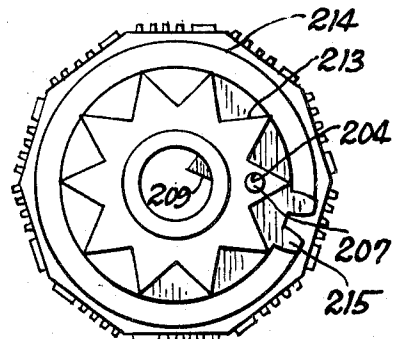


FIG. 26

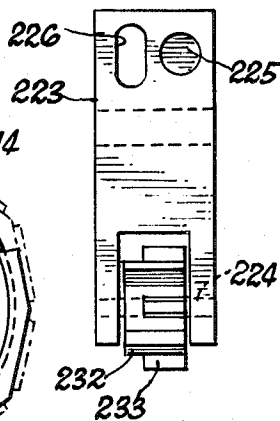


FIG. 27

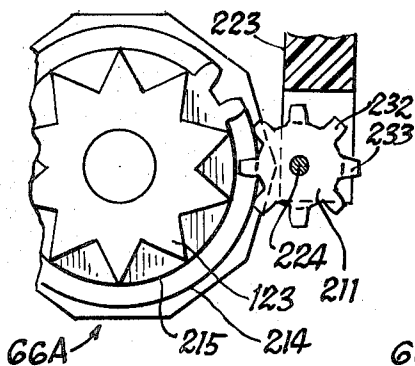
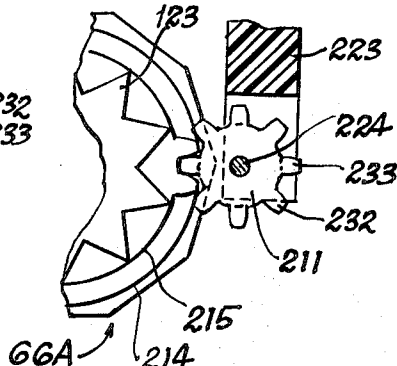
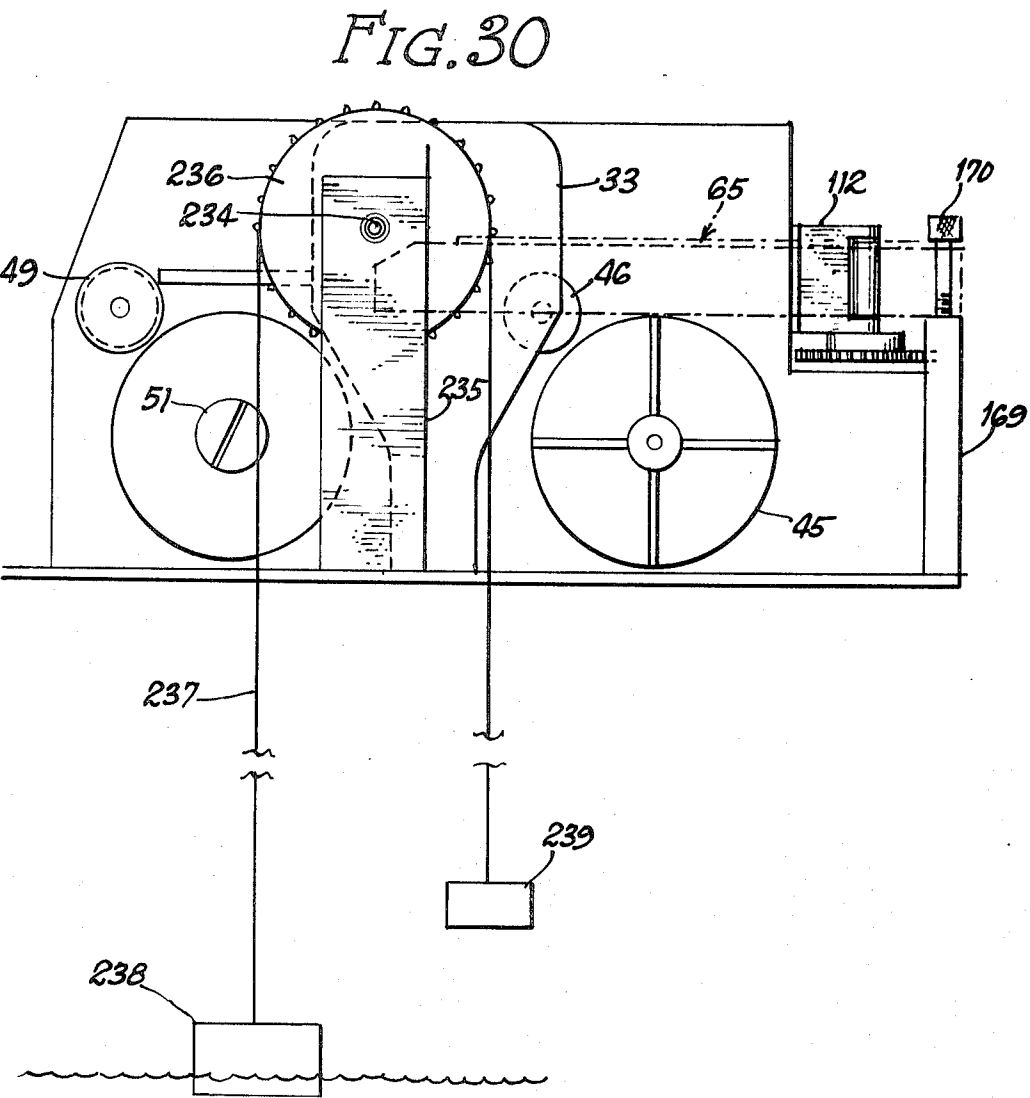
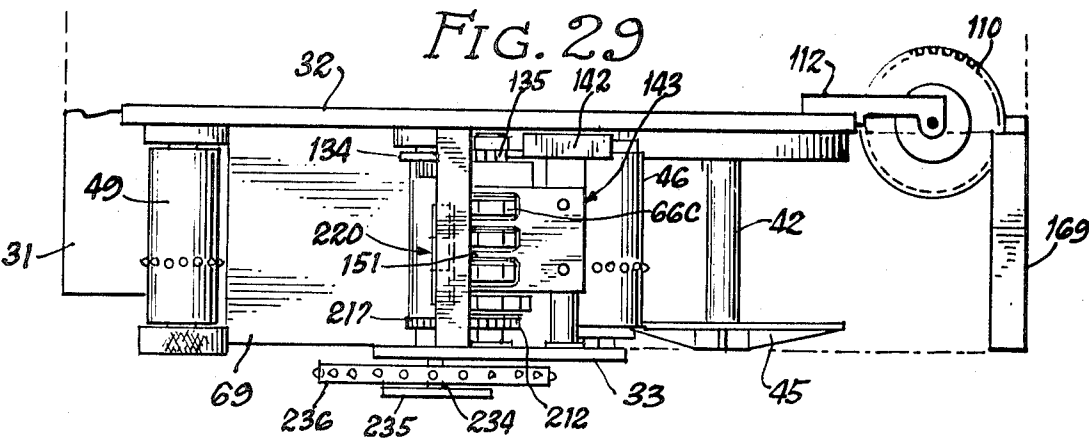


FIG. 28





RECORDING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a recording device. It more particularly relates to a device with a mechanical counter to accumulate count of vehicular traffic and to periodically print the accumulated count on tape along with an automatic resetting of the counter to zero at predetermined intervals. The device without the resetting components is useful to monitor liquid level, e.g., the level of a river.

2. Description of the Prior Art

With respect to the device as a traffic counter, the most pertinent prior art device is a traffic counter previously made and sold by the Streeter Amet Division of the assignee of the present patent application under the trademark "Recodet." Like the device of the present invention it includes a counter-printer with the counter being driven by a motor that is driven by pulses generated through a system. A base plate supports a single vertical plate that provides only cantilever support to the mounting bracket that supports an assembly of printing rolls above the counter wheels. Those rolls are moved in a rocking motion across and then back across the printing zone. This motion with the double passage of the rolls through the printing zone can result in a poor quality print if the paper has moved slightly before the return movement. The assembly of counter wheels on their shaft have that shaft supported in a cantilever manner by its support at one end by a plate supported by the vertical plate and not also directly supported by the base plate.

That traffic counter had counter wheels constructed of two pieces to enclose a spring-loaded pawl used for resetting. One piece was a disc with a peripheral flange having a decagonally shaped outer surface and a cylindrical inner surface. The other piece fit inside the flange and the two pieces were secured together. This construction did not provide the rigidity at the perimeter required for accurate definition of printing. Such accuracy is needed because tape is printed to duplicate long and short line indicia corresponding to that embossed on the particular portion of the peripheral surface of the wheel. Those indicia on the printed tape are optically read by a tape reader to convert the information to a more useful form.

That earlier traffic counter had another disadvantage that is time consuming. The supply spool of ink ribbon and the takeup spool were mounted on the vertical support plate with their axes normal to that plate and the ribbon was threaded across the printing zone to print the bottom side of the paper tape and then back to the take up spool. For convenience of visual reading of a top side print the ribbon was threaded again across the paper tape but this time above it, in alignment with the lower run. Then recent printings could be visually read conveniently without looking to the bottom side of the latest portion of the tape.

U.S. Pat. No. 2,195,869 discloses a recording device stated to be useful to record traffic flow using a mechanical counter with a printing mechanism and using a continuous ribbon and an ink-supply roll. The ribbon passes through the printing zone in the direction of travel of the paper tape to be printed and this must be of substantial width. The shaft for the counter

wheels is supported in a cantilever mounting. Quality of the inked ribbon is dependent on the efficacy of the ink supply roll and that will vary with temperature and presumably with time.

In the device of U.S. Pat. No. 2,540,033 the assembly of counter wheels is supported at both ends by vertical plates supported by a base plate rather than being supported at one end in a cantilever manner. A print bar is mounted below the wheels and is moved up for the printing operation. Spools for the ribbon are mounted above the counter wheel assembly with their axes vertical. The device includes ribbon feeding and reversing mechanism. Placement of a new ribbon requires manual threading of it.

The device of U.S. Pat. No. 2,688,445, similar to U.S. Pat. No. 2,195,868, passes an ink ribbon through the printing zone in the direction of travel of the paper tape. The device has two spools for the ribbon and they are on opposite sides of the printing zone. Manual threading is required. The width of the ribbon must equal the transverse width of the printing zone occupied by counter wheels.

Ink ribbon cartridges are used in some typewriters. See U.S. Pat. No. 2,986,260. These, like magnetic tape cartridges exemplified by U.S. Pat. No. 3,075,717, have a ribbon on one spool and connected to a second spool mounted on parallel axes in a casing of the cartridge with none of the length of the ribbon between the spools being oriented by guide means integral with the cartridge in a path that presents the operating surface of the ribbon at a working zone in a plane other than parallel to the axes of the spools. Other patents disclosing replaceable ribbon cartridges are U.S. Pat. Nos. 3,075,627; 3,513,957; and 3,615,155.

U.S. Pat. No. 3,549,823 has guide means to change the orientation of the ribbon to parallel to the common axis of the spools but this is provided merely to change direction and elevation. There is no change at the working zone.

There are numerous patents relating to counter wheels and counter wheel assemblies. The first three patents mentioned above disclose various constructions of counter wheels. Other patents disclosing other constructions of counter wheels are U.S. Pat. Nos.: 2,444,570; 2,687,937; 2,730,425; 2,737,345; 2,858,986; 2,870,962; 2,922,689; 2,966,301; 2,996,241; 3,070,300; 3,147,918; 3,211,371; 3,471,085; 3,471,086; 3,529,769; and 3,596,067.

SUMMARY OF THE INVENTION

The recording device of the present invention includes a rigid support assembly comprising a base plate, a rear vertical main plate fixedly mounted on the base plate, and a front vertical auxiliary plate fixedly mounted on the base plate in parallel with but spaced from the main plate, and standoff rods between and fixedly secured to the vertical plates.

The device also includes: a counter assembly having counter wheels and mounted on and between the vertical plates at a printing zone; a printer assembly mounted on and between the vertical plates and below the counter assembly; power-driven means mounted on the support assembly to move a printable tape in a horizontal path of travel through the printing zone parallel to the vertical plates and between the counter

wheels and the printer assembly; means mounted on the support assembly to support the tape at a horizontal plane before passage of the tape below the counter wheels; means mounted on the support assembly to support the tape at said horizontal plane after passage below the counter wheels; and an ink ribbon cartridge mounted on the support assembly and containing a casing, an ink ribbon, a supply spool for the ribbon and rotatably mounted on the casing, a takeup spool for the ribbon and rotatably mounted on the casing, and guide means as an integral part of and adjacent one end of the cartridge to direct a part of the ribbon extending between the spools in a manner so that a printing surface of that part of the ribbon is at the printing zone below the counter wheels and extends horizontally across but spaced from the path of travel of the tape. The device further includes: means to move periodically the printer assembly towards the counter wheels for a printing operation; means to operate the power-driven means for the tape to advance the tape after each printing operation; and means to operate the counter assembly.

The device of the invention preferably has more specific construction for some of its components mentioned above as will be apparent from the detailed description. In the especially preferred embodiment there are additional specified components that provide and insure high quality printing of coding indicia for adequate automatic optical reading of the resultant printed tape. In that especially preferred embodiment components are included for automatic periodic resetting of the counter wheels at selected predetermined periods of time, such as every cycle of printing operation.

In the especially preferred embodiment of the device the counter wheels have a novel construction to provide a substantially rigid periphery containing embossed indicia at each of its polygonal side portions. Each counter wheel is constructed to provide radial support to the central opening across the entire width of each polygonal side portion instead of being constructed with polygonal side portions as parts of a peripheral flange without such support. Each counter wheel is a one-piece construction.

When the device is used in a manner in which periodically the counter wheels are reset to zero position, as is the case for the especially preferred embodiment that is useful for counting traffic, the counter wheel is a one-piece component of a counter wheel subassembly for the counter assembly. The other components of the subassembly are a pawl, a spring and a pin mounted and secured in a noncentral hole. The pin has an enlarged head and the shank adjacent the head is enlarged. The noncentral hole is enlarged by a deep recess at one face of the wheel and the outer portion is further enlarged by a shallow recess to permit pivotal movement of the pawl on the enlarged shank portion of the pin above a spring helically wound about the enlarged shank in the deep recess with one free end of the spring abut a wall portion of the deep recess shaped to prevent rotational movement of the spring in one direction about the pin. The other free end of the spring engages the pawl so that the pawl is biased into the central opening of the wheel to engage a notch in the shaft on which the wheel is rotatably mounted. This

engagement rotates the wheel when the shaft is rotated in one direction but, of course, permits free rotation of the wheel in the same direction relative to the shaft.

This one-piece counter wheel is molded thicker than the width of the polygonal sided periphery and has a coaxial integral gear on one face. Between the polygonal-sided periphery and the other face the periphery is multisteped to provide at the outer stepped portion adjacent that face a star gear having the same number of teeth as the sides of the polygonal sides of the periphery with the base between each tooth aligned with the center line of each polygonal side. The intermediate stepped portion provides a locking ring that is notched in alignment with and shaped like the notch between the teeth of a two-tooth segment integral with it and extending toward teeth of the star gear. The locking ring and the two-tooth gear segment have a slightly larger diameter than the diameter of the integral gear on the other face of the wheel and thus on the corresponding integral gear of the next higher order gear that is engaged by the pinion turned by the gear segment.

This novel difference in diameters in combination with the novel individual spring-biased pivotal mounting of brackets for pinion gears makes possible the avoidance of ambiguity due to marginal pinion engagement as can occur when there is a common shaft on which pinions are rotatably mounted and which is mounted on a bracket pivotally mounted for movement of the pinions away from the counter wheels by the gears during the resetting of the latter.

In this especially preferred embodiment of the device of the invention the means to rotate the shaft, on which the counter wheels are mounted, is constructed to turn the shaft through two complete revolutions to eliminate any remaining possibility of reset error that may occur otherwise when under certain conditions the counter wheel is positioned to indicate a print of "nine" for the wheel at the time reset is started or if the reset pawl should fail to drop into the notch of the shaft mounting the wheels after a wheel completes a revolution and the counter wheel is then positioned to indicate a print of "zero."

The disclosed embodiments of the present device contain the star gear on each device to be engaged by a rocked correlator-and-locking mechanism of the device. That mechanism is pivotally mounted and has fingers engaging the star gears prior to printing to ensure horizontal positioning of the downwardly facing side of the polygonal periphery indicating that digit of the decimal number counted or otherwise indicated. The device is maintained locked in correlating position until completion of a printing operation. The device includes means operatively associated with means to move the printer assembly to perform this function so that the fingers are moved into and out of position, before and after, respectively, the printing operation.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view, partially broken away, of the especially preferred embodiment of the device of the invention showing the outline of the ink ribbon cartridge in phantom lines.

FIG. 2 is a fragmentary top plan view, partially broken away, of that embodiment without the ink ribbon cartridge.

FIG. 3 is a perspective view of the ink ribbon cartridge of the invention.

FIG. 4 is a rear elevational view of that embodiment of the device without the clock and switch operated by it and without the cartridge.

FIG. 5 is a fragmentary section of the device taken along the line 5—5 of FIG. 4.

FIG. 6 is a fragmentary section of the device taken along the line 6—6 of FIG. 4 with the cartridge in place but with the clock and its mounting absent.

FIG. 7 is a section of the device taken along the line 7—7 of FIG. 6.

FIG. 8 is a fragmentary top plan view of the ink ribbon cartridge.

FIG. 9 is an illustrative plan view of a section of the tape printed by the device of the invention.

FIG. 10 is a fragmentary section of the device taken along the line 10—10 of FIG. 2.

FIG. 11 is a fragmentary section taken along the line 11—11 of FIG. 7.

FIG. 12 is a fragmentary view taken along the line 12—12 of FIG. 11.

FIG. 13 is a perspective view of the cam follower and clutch detent arm component of the device best shown from above in FIG. 5 and from below in FIG. 12 when in mounted position.

FIG. 14 is a fragmentary perspective view of the ink ribbon of the cartridge illustrating its path of travel in the end of the cartridge shown in FIG. 8 with the shield openings shown in phantom lines.

FIG. 15 is a fragmentary section of the ink ribbon cartridge taken along the line 15—15 of FIG. 7.

FIG. 16 is a fragmentary section of the cartridge taken along the line 16—16 of FIG. 17.

FIG. 17 is a fragmentary section, partially broken away, of the cartridge taken along the line 17—17 of FIG. 16.

FIG. 18 is a fragmentary bottom plan view, partially broken away, of the cartridge.

FIG. 19 is an enlarged perspective view of one corner of the cartridge as seen in the bottom left end of the view in FIG. 3 but with the guide cover removed.

FIG. 20 is a perspective view of that guide cover.

FIG. 21 is a fragmentary vertical section of the device, along a line that is parallel to and between lines 6—6 and 10—10 of FIG. 2, is in front of the main vertical support plate, and shows in phantom lines some components in front of the sectional line.

FIG. 22 is a front elevational view, partially broken away, of the counter wheel subassembly of the invention.

FIG. 23 is a rear elevational view of the assembly shown in FIG. 23.

FIG. 24 is a top plan view of the counter wheel shown in FIGS. 22 and 23.

FIG. 25 is a fragmentary, partially broken away, section of the device taken along line 25—25 of FIG. 7.

FIG. 26 is an elevational view of the pinion and its pivotal mounted bracket shown in FIG. 25.

FIG. 27 is a fragmentary section of the device looking in the opposite direction to that of FIG. 26 and facing the other side of the counter wheel.

FIG. 28 is a fragmentary view like that of FIG. 27 but showing the pinion engaging the moving gear segment during movement of the next higher order wheel by one digit.

FIG. 29 is a fragmentary top plan view of the other preferred embodiment of the device of the present invention without showing the cartridge and the motor, gear device, etc. to the rear of the main vertical plate.

FIG. 30 is a fragmentary elevational view of the embodiment shown in FIG. 29.

DETAILED DESCRIPTION

Referring to FIGS. 1 and 2, the device has a base plate 31, a rear vertical main plate 32 and a front vertical auxiliary plate 33. The plate 32 is fixedly mounted on base plate 31 by screws 34 and plate 33 is similarly mounted on base plate 31 by screw 35 to be spaced from and parallel to plate 32. Standoff rods 36 and 37 (FIG. 6) are mounted between plates 32 and 33 and secured to these plates by screws 38 to maintain the spacing. The plates and rods thus secured provide a support assembly with a printing zone between plates 32 and 33.

The device includes a counter assembly generally indicated at 39 (FIG. 7) and a printer assembly general indicated at 40 (FIG. 5).

A roll of paper tape 41 is mounted on a supply spindle 42 that is fixedly mounted on and extending horizontally from rear plate 32 in a forward direction. The spindle 42 extends through central hole in a guide disc 43 mounted on the front face of rear plate 32. A spring washer 44 is secured on the front face of the intermediate enlargement of spindle 42 at the opening of disc 43. The spring washer 44 supplies a constant drag to the paper tape supply spool. A keeper disc 45 is mounted on the small diameter free end of spindle 42 and secured there by a screw (not shown) to retain the roll of tape 41 on spindle 42.

The free end of the roll is passed over a supply sprocket 46 of cylindrical configuration with sprocket teeth 47 around it at an intermediate position of the cylinder to be in alignment with and engage tape 41 at its equally spaced perforations 48 (FIG. 9). The tape then passes through the printing zone between counter assembly 39 and printer assembly 40 and over and partially around a drive capstan sprocket 49 having the same construction as sprocket 46 with its teeth 47 engaging tape 41.

The free end of tape 41 is inserted in a longitudinal slot 50 in a takeup spindle 51 rotatably mounted on rear plate 32 and extending forwardly through central hole in a rear standoff 52 extending through a hole in plate 32 and having an enlarged front portion (FIG. 1) on the front side of rear plate 32 and a frustoconical rear portion (FIG. 5). The front portion serves as a guide disc for tape 41, like guide 43, and is secured by screws (not shown). Fixedly mounted on the rear end of spindle 51 rearwardly of standoff 52 is a pulley 53 driven by a belt 54 engaging a pulley 55 fixedly mounted on a shaft 56 that extends through a mounting boss 57 extending rearwardly through plate 32 and secured thereto by screws (not shown). The capstan sprocket 49 is fixedly mounted on the forward end portion of shaft 56 behind a knob 58 secured on the end of shaft 56.

The supply sprocket 46 is fixedly mounted on a shaft 59 rotatably mounted on the upstanding legs 60 of a U-shaped support bracket 61 mounted at its ends by pins 62 and screws 63 (FIG. 21). The upper portions of legs

60 are thinner so as to provide outer horizontal ledge support surfaces 64 for a replaceable ink ribbon cartridge generally indicated at 65 (FIG. 3).

Because supply sprocket 46 and capstan sprocket 49 are precisely located relative to counter print wheels 66, 66A, 66B and 66C (FIG. 7), the printed data are accurately oriented on tape 41 relative to its perforations 48. The paper tape takeup spindle 51 receives, winds and stores tape 41 until final removal.

A horizontal desk 69 is mounted on plates 32 and 33 between the printing zone and capstan sprocket 49 to support tape 41.

A ratchet assembly generally indicated at 70 (FIG. 4) advances capstan sprocket 49 after each print and also allows for manual override. This assembly includes pulley 55 that drives belt 54 to drive pulley 53 to the extent that the advanced paper tape 41 is wound onto spindle 50. By the use of pulleys 53 and 55 made of nylon and a silicone O ring for belt 54, subsequent motion is lost through slippage of belt 54 on pulleys 53 and 55.

The ratchet assembly 70 is driven by a link 71 pivotally connected at one end to a cam follower arm 72 (FIG. 10) to which an oscillating motion is imparted by a cam 73 integral with a paper tape drive gear 74 of a gear cluster generally indicated at 75. The ratchet assembly 70 includes a ratchet wheel 76 fixedly mounted on shaft 56 forwardly of pulley 55. One end of an arm 77 is pivotally connected to the other end of link 71. The arm 77 is rotatably supported at its center by shaft 56. On the other end of arm 77 there is pivotally mounted a pawl 78 (FIG. 4) engaging ratchet wheel 76 to turn it clockwise (as viewed in FIG. 4) when link 71 is moved to the right (also as viewed in FIG. 4) for tape 41 advancement by sprocket 49 that is turned when wheel 76 is thus moved.

This movement of link 71 by pivotal movement of cam follower arm 72 is opposed by a spring 79 mounted on the small diameter end of a rear standoff rod 80 fixedly mounted on rear plate 32. One end 81 of spring 79 engages follower arm 72 and the other end 82 engages a stationary gear shaft support bracket 83 (FIGS. 4 and 5) fixed mounted at one end on rod 80. As a result, spring 79 returns follower arm 72 to its normal position when as cam 73 passes beyond follower arm 72.

The pawl 78 is mounted by a pin 84 secured on arm 77 and a spring (not shown) on pin 84 urges pawl 78 against wheel 76.

A bracket 85 is fixedly mounted on the rear end of mounting boss 57. A pin 86 rigidly mounted on the free end of bracket 85 rotatably supports a locking pawl 87 (FIG. 10) urged by a spring (not shown) to prevent reverse movement of wheel 76 when follower arm 72 is returned to its normal position.

The counter print wheels 66, 66A, 66B and 66C are mounted on a shaft 88 rotatably supported by plates 32 and 33 and extending rearwardly of plate 32. At the distal or rear end of this extension of shaft 88 is fixedly mounted a knob 89 (FIG. 7) for manual resetting of wheels 66, 66A, 66B and 66C, if desired, by rotation of knob 89 counterclockwise (as viewed in FIG. 1). Forwardly of knob 89 an adjust bracket 90 is fixedly mounted on shaft 88. The adjust bracket 90 contains screws 91 (FIG. 7) that engage the flat surface of a

semi-cylindrical boss 92 of a reset gear 93 rotatably mounted on shaft 88. Rotatably mounted on shaft 88 between gear 93 and plate 32 is an integral time index finger 94 and gear 95.

The gear 95 is driven by a transfer gear 96 driven by a gear 97 of a compound gear having also a gear 98 of larger diameter and an index finger 99. This compound gear is fixedly mounted on a shaft 100 of printer assembly 40. The shaft 100 is rotatably mounted on plates 32 and 33 and extends rearwardly of plate 32 for the mounting of the compound gear. A large knob 101 is fixed on shaft 100 at its rear end to permit manual override.

The gear 98 is driven by a gear 102 driven by a drive arm 103 (FIG. 10) secured on the output shaft of a gear box mounted on one end of a motor 104 having an output shaft and a gear on both ends of it (not shown). The gear 102 is rotatably mounted on that output shaft of that gear box.

The motor 104 is mounted by mounts 105 on the rear face of rear plate 32. A gear box 106 is mounted on the other end of motor 104 and it has an output shaft 107 on which are fixedly mounted a cam 108 and a gear 109 meshing with a gear 110 fixed on a vertical shaft 111 journaled on a bracket 112 mounted on plate 32. A roller 113 is also fixedly mounted on shaft 111 and frictionally engages discs 114 (FIG. 3) of a ribbon takeup spool 115 of ink ribbon cartridge 65.

The cam 108 during one revolution per cycle of printing operation moves an actuator arm 116 pivotally mounted on motor 104 against a switch 117 to open it and thereby open a holding circuit for motor 104 to stop the motor. The switch 117 is also mounted on the housing of motor 104.

As seen in FIGS. 5 and 7, the rearward extension of shaft 100 of printer assembly 40 has rotatably mounted on it also a cam follower and clutch detent arm component 118 shown by itself in FIG. 13. Its cam follower is engaged in sequence by three lobes 119 (equally spaced) on the boss of a reset cam 120 (FIG. 7) rotatably mounted on a shaft 121 mounted on and extending rearwardly from plate 32. The transfer gear 96 is also rotatably mounted on shaft 121. The component 118 is positioned so that its cam follower rides on the boss of reset cam 120. Turning of component 118 as lobe 119 moves past extends a spring 122 connected (FIG. 2) to a tab extension of component 118 and to a pin on rear standoff rod 80. Upon the passing of lobe 119 beyond the cam follower, spring 122 returns component 118 to its normal position. The gear shaft 121 is connected at its other end to bracket 83 secured at its other end to rear standoff rod 80.

The finger 99 of the compound gear on shaft 100 engages the 12-point reset cam 120 during each rotation of shaft 100 to turn it one position. (This cam 120 is replaceable by other cams, such as cams containing one, four or 12 lobes 119).

The cam follower of component 118 is moved downwardly by a lobe 119 every fourth time that cam 120 is moved, i.e., every fourth cycle of operation including a complete rotation of shaft 100 for printing. This downward movement also produces a downward movement of the clutch detent arm of component 118 as it turns about the axis of shaft 100. This releases a reset clutch 123 by permitting its spring-loaded clutch

key 124 (FIGS. 7 and 12) to engage the then-rotating clutch dog 125. The clutch 123 is rotatably mounted on gear shaft 121. The clutch dog 125 is rotating at full velocity because integral with it is a gear 126 meshing with gear 74 on shaft 100. The unitary dog 125 and gear 126 is rotatably mounted on shaft 121. Integral with clutch 123 is a gear 127 that meshes with gear 93 fixed on shaft 88 (FIG. 7). Thus release of clutch 123 results in rotation of shaft 88 to reset counter assembly 39. A single revolution of reset clutch 123 and gear 127 results in two complete revolutions of counter shaft 88 because of the use of the gears for gear 127 and gear 93, e.g., a 48P-80T gear 126 and a 48P-40T gear 93. The counter shaft 88 is rotated twice for each reset of counter assembly 39 to eliminate possible ambiguity in the positioning of counter print wheels 66, 66A, 66B and 66C.

When reset cam 120 is advanced and a cam lobe 119 on its boss is present to turn component 118 by movement of its cam follower, the clutch detent of component 118 is moved away from clutch 123 and then key 124 by the spring in clutch 123 is moved into engagement with rotating clutch dog 125 for a single revolution of clutch 123. This occurs after about 75° of the total 360° rotation of shaft 100 of printer assembly 40, i.e., of the total 360° cycle of operation for printing followed by advance of paper tape 41.

The single revolution (360°) of clutch 123 occurs while shaft 100 rotates an additional 240°. This is accomplished by a 1½:1 gear ratio between paper tape drive gear 74 on shaft 100 and gear 127 on shaft 121. Since clutch motion does not begin until 75° of the mechanism motion (single rotation of shaft 100) has occurred and is completed in an additional 240°, this allows for 45° remaining mechanism motion in which to disengage clutch 123 and to bring the total mechanism to a halt.

The key 124 is kept engaged by the spring of clutch 123 until completion of the single rotation of clutch 123 at which time the detent arm of component 118 moves key 124 from dog 125. The component 118 was returned by spring 122 to its normal position when lobe 119 moved past the cam follower of component 118 during the movement of reset cam 120 that initially permitted release of clutch 123.

The reset cam 120 is engaged by a detent spring 128 (FIG. 10) to insure that lobes 119 are not moved except when cam 120 is moved by finger 99 of the compound gear having gears 97 and 98 fixedly mounted on shaft 100. The detent spring 128 is mounted by a bracket 129 on plate 32.

A clutch locking detent 130 (FIG. 10) is mounted on the housing of motor 104 and engages gear 127 integral with clutch 123 to stop free movement of shaft 88 of counter assembly 39.

The mounts 105 for motor 104 are secured to plate 32 by screws 131 (FIG. 1), one of which has access to plate 32 by an opening in guide disc 43.

The time wheel finger 94, during each revolution, engages a 12-tooth time indexing wheel 132 which is fixedly mounted on a stub shaft 133 journaled in plate 32 (FIG. 10). The front end of shaft 133 has secured on it an indexing cam 134 that in the illustration provides engagement every fourth print with a gear 135 integral with a time wheel 136 to move it one twenty-fourth of a

complete revolution. The round wheel 136 is constructed to indicate military time in that it has 24 raised print indicia on its periphery to provide 24 print positions from 01 to 24 inclusive. The wheel 136 is rotatably mounted on shaft 88.

The time indexing wheel 132 is engaged by a detent spring 137 mounted on a bracket 138 mounted on the rear face of plate 32.

The time wheel 136 has its gear 135 engaged (FIG. 21) by a time wheel detent 139 rotatably mounted on a shaft 140 journaled in plates 32 and 33 and extending rearwardly of plate 32. The other end of detent 139 is connected to one end of a spring 141 that is connected at its other end to a detent lock bracket 142 fixedly mounted on shaft 140 and having an upper horizontal extension overlying the detent arm of wheel detent 139 so that spring 141 insures engagement of the detent end of detent 139 with gear 135 to prevent easy movement of time wheel 136 except by movement of one of the three corners of cam 134 through an engagement with gear 135 for turning the latter. Furthermore, a turning of shaft 140 counterclockwise (as viewed in FIG. 21) moves detent lock bracket 142 down onto the detent end of detent 139 to lock the latter in engagement with gear 135 so that wheel 136 cannot move. This occurs shortly before and continues until shortly after a printing of tape 41 described below. The shaft 140 is a component of a correlator-and-lock assembly generally indicated at 143 (FIGS. 2 and 7).

The transfer gear 96 is a correlator drive gear, that is, it indirectly turns shaft 140. This is because integral with gear 96 is a cam 144 that early in the operation of motor 104 and thus early in the single revolution of gear 96 abuts correlator drive arm 145 (FIG. 10) rotatably mounted on shaft 140 and turns arm 145 counterclockwise (as viewed in FIG. 10) until cam 144 moves past arm 145. During this movement of arm 145 it abuts an extension of a bracket 146, each receiving in opposed cylindrical recesses the end of a spring 147 that becomes compressed by this movement. Further turning of arm 145 by cam 144 turns bracket 146 and thus shaft 140 on which it is fixedly mounted. The return movement occurs after the printing operation has been completed.

When bracket 146 is moved by arm 145 it distorts a spring 148 connected at one end to a screw 149 and at the other end to plate 32. The shank of screw 149 passes through a larger oval hole in that extension of bracket and its threaded end is screwed into a tapped hole in arm 145. Thus the return movement is caused by spring 148 moving screw 149 to the right (as viewed in FIG. 10) to provide that movement to the upper part of arm 145 and ultimately that movement by the head of screw 149 to the upper extension of bracket 146. This returns the lower part of arm 145 to the position to be moved again by cam 144 for the next cycle of operation of the device.

This makes possible a gentle initial turning of shaft 140 for a correlation function and then a forceful movement for the locking function and later a reverse turning of shaft 140.

The shaft 140 has fixedly mounted on it between plates 32 and 33 a correlator 150 (FIG. 6) of correlator-and-locking assembly 143. The correlator 150 has an extension to the left, as viewed in FIG. 6, and from

the extension a set of four fingers 151 having downwardly pointing V-shaped extensions are located to be moved into engagement by each with a 10-tooth star gear 152 (FIG. 23) integral with one of the counter print wheels 66, 66A, 66B, and 66C. This positions and locks the then bottom side of the decagonal counter print wheel at a horizontal plane for the printing operation.

As seen in FIGS. 1 and 2, a clock-mounting bracket 153 is mounted on plate 32. A clock face 154 is secured on the clock's output shaft 155 by a knob 156. In the illustration, face 154 supports magnets 157 at four equidistant radial positions so that for each 1-hour single revolution of face 153 a reed switch 157 is closed four times for a brief interval, the closings being at 15-minute intervals, to initiate starting of motor 104 that continues to run then for a complete revolution of shaft 100. Then motor 104 stops because switch 117 in a holding circuit for motor 104 is opened by cam 109 moving actuator 116 against switch 117.

The printer assembly 40, that includes shaft 100, further includes a comb bracket 160 fixedly mounted on shaft 100 between plates 32 and 33 (FIGS. 1, 5 and 6). The comb bracket 160 has a number of "teeth", i.e., a number of finger 161, each with a transverse hole in alignment with each other and in which a shaft 162 is fixedly mounted. Pivotaly mounted on shaft 162 are five spring-loaded print-roll-mounting brackets 163, each of which comprises in a one-piece construction a plate from the longitudinal edges of which extends two generally L-shaped plates in both directions to provide on one side a clevis for the pivotal mounting on shaft 162 and on the opposite side of the central plate of bracket 163 a clevis for mounting a pin 164 on which is rotatably mounted a print roll 165. The L-shaped plates have an angle of greater than 90°. The pins 164 and shaft 162 are on the same side of shaft 100. The print rolls 165 are in alignment with counter print wheels 66, 66A, 66B, 66C and time wheel 136 and are below paper tape 41 at the printing zone.

The other end of the central plate of each bracket 163 has an oval hole in which there is a screw 166 threaded into bracket 160 that has, adjacent to screw 166, in a cylindrical recess a spring 167 that extends to and abuts the central plate of bracket 163 to urge it and thus rolls 165 outwardly about shaft 162 to the extent permitted by the adjustment individually of screws 166. The complete revolution of shaft 100 of printer assembly 40 moves print rolls 165 through a cyclic path that includes an arcuate path at the top of the travel to perform the printing operation on the upwardly facing surface of tape 41 that is lifted with ink ribbon 168 of cartridge 65 above tape 41 by rolls 165, to the aligned downwardly facing print side portion of the decagonal printing peripheral surface of the wheel or of one of the 24 printing peripheral surface portions of time print wheel 136, as the case may be. Thus printing occurs during one pass of the print rolls, individually adjusted for printing pressure by adjustment of screw 166. This printing occurs when assembly 143 is at its locking position. Adjustment of screw 166 will vary the radius of print roll 165 about the axis of shaft 100 thereby regulating the print quality. Adjustment is necessary when there is a substantial change in ambient temperature. For example, an adjustment for suitable printing

at 0° F. ambient temperature can result in undesirable background printing at high temperature, e.g., 165° F. Background printing must be avoided as the printing of parallel long and short lines duplicating raised indicia on a print side of a counter wheel corresponding to a binary code for a number on that side indicates a digit of the number counted. That digit is also printed from the corresponding raised digit on that side but this is done for convenience of visual reading, if desired, of the digit represented by the binary code. However, it is the printing of the set of parallel lines that provides printed information that must be accurately produced without extension of short lines by background printing so as to be accurately read by an optical reader.

The indicia of a digit from 0 to 9 by a binary code can be seen on the section of printed tape 41 shown in FIG. 9. The long lines represent 1 and the short lines represent 0 in the binary number system. For example the number 6 is represented by 0110 while 7 is represented by 0111.

The ink ribbon cartridge 65 is supported at one end by a bracket 169 mounted on and extending forwardly from one end of plate 32. The cartridge 65 is fixed on bracket by screws 170, easily removed to replace cartridge 65 when all or almost all of ribbon 168 has been used for printing by the single pass of ribbon 168 through the printing zone. Reuse of ribbon 168 would degrade print quality and thus affect reliability of optical reading.

In the preferred embodiment of cartridge 65 of the invention shown in the drawings cartridge 65 is rectangular in a plan view and it is several times longer than it is wide. The width is approximately the space between plates 32 and 33 so that one end can be at the printing zone while the other is mounted on bracket 169.

The cartridge 65 has a one-piece component, as a casing, comprising a horizontal bottom 171; an end wall 172; front and rear walls 173 and 174, respectively, extending beyond the other end of bottom 172; a transverse wall 175 extending between walls 173 and 174 but spaced a short distance from them at the other end of bottom 171; a transverse wall 176 extending from wall 173 to but spaced from wall 174 a greater distance than wall 175 is spaced from wall 174; and a raised horizontal platform or ribbon deck 177 extending from wall 175 having its longitudinal edges parallel to but spaced from the extensions of front and rear walls 172 and 173, except at the distal end of platform 177 where it has horizontal lateral tabs joined to the end portions of the extensions of front and rear walls 172 and 173.

The distal end of platform 177 has a rectangular opening 178 beyond which it is thicker for strength. Intermediate opening 178 and wall 175 is a slot 179 parallel to but spaced from the longitudinal axis of cartridge 65. The slot 179 is present to provide clearance for teeth 47 of supply sprocket 46 when cartridge 65 is in position in the device of the invention.

Also molded integral with bottom 171 and extending upwardly from it are a vertical spindle 180 between walls 175 and 176 and a vertical spindle 181 between wall 176 and end wall 174. The spindle 181 is offset from the longitudinal axis of cartridge 65, and rear wall 173 and bottom 171 have an opening and an arcuate notch, respectively, in transverse alignment with spindle 181.

The cartridge 65 has a cover 182 extending from end wall to a point past slot 179 in raised platform 179. The cover has holes in alignment with pins (not shown) extending upwardly from the bulbous rounded ends of wall 175 and holes in alignment with thickened corners at the junctures of end wall 174 with walls 172 and 173 to secure cover 182 to walls 172, 173 and 174, after placement of a supply spool 183, with ink ribbon 168 on it, on spindle 180 and takeup spool 115 on spindle 181 and threading of ribbon 168 for making the cartridge assembly as described later. The thickened corners have vertical holes through them to receive screws 170 when mounting the cartridge assembly. The cover 182 has a notch in vertical alignment with that in bottom 171. These notches and the opening in wall 173 are required for contact of discs 114 of spool 115 on offset spindle 181 by roller 113 so that spool 115 can be turned to move ribbon 168 during the cycle of operation of the device of the invention.

The platform 177 has, adjacent its longitudinal edges, downwardly extending vertical flanges 185 (FIG. 16) and substantially above the bottom of flanges 172 and 173. They are strengthening flanges.

The cartridge assembly 65 further includes an upper thin bronze ink ribbon shield 186 and a lower thin bronze ink ribbon shield 187 secured by fasteners 188 on platform 177. Both shields 186 and 187 have a set of four rectangular openings 189 and a rectangular opening 190. These openings are at a transverse plane and are above opening 179 in platform 177. The fasteners 188 are located sufficiently close to wall 175 to permit upward movement of the end portions, containing openings 189 and 190, of shields 186 and 187 with ribbon 168 between them when print rolls 165 raise paper tape 41 and ribbon 168 toward the counter print wheels and time wheel 136. Thus, openings 189 and 190 are located so that, when cartridge 65 is in place, these openings will be directly below the counter wheels and time wheel 136. The shields 186 and 187 are sufficiently wide to rest normally on the margins of platform 177 at opening 178 to space ribbon 178 normally above tape 41. After rolls 165 move past tape 41 etc., the raised portion of shields 186 and 187, being resilient, return to their normal position on platform 177.

At the distal end portion of the extension of front wall 172 it has a thinner wall portion 192 with its front surface recessed rearwardly of the front surface of the rest of wall 172. The wall portion 192 has an intermediate rectangular notch 193 at its bottom. Above notch 193 wall portion 192 has been cut away to provide a top edge 194 that is inclined downwardly toward the distal end of wall 172. The front face of wall portion 192 has integral knobs 195. Mounted on the front of thinner wall portion 192 is a guide cover plate 196 that has thicker vertical marginal portions 197 containing holes 198 to receive knobs 195 for securing guide plate 196 to wall portion 192 after completion of threading ribbon 168 over inclined edge 194, through notch 193, up between wall portion 192 and platform 177, and between shields 186 and 187.

The rear wall 174 has a construction similar to wall 173 at the distal end of its extension but its inclined top edge 199 and bottom notch 200 are offset to be closer to wall 175 so that ribbon from between shields 186 and 187 after passage down between platform 177 and

wall 173 passes through notch 200, upwardly behind the extension of wall 173, is turned over inclined top surface to pass between platform 177 and wall 173 with its printing surface in a vertical plane. Then ribbon is threaded through the space between rear wall 173 and transverse wall 175, through the space between rear wall 173 and intermediate transverse wall 176. The free end of ribbon 168 is connected to takeup spool 115. For the initial threading, the free end of ribbon 168 is first passed through the space between front wall 172 and transverse wall 173 to inclined top edge 194 over which it is turned 90°.

The thinner wall portion having inclined top edge 199 and notch 200 has knobs 201 to which is secured a wider cover guide plate 202.

It is seen that cartridge 65 is so constructed that ribbon 168 from supply spool 183 to takeup spool 115 is caused to change directions approximately as follows: 90°, 180°, 90°, 90°, 180° and 90° with ribbon 168 having its printing surface at a horizontal plane between the intermediate 90° changes in direction to be parallel to paper tape 41 below it and a print side of each counter print wheel and of time wheel 136. This path of movement is shown in FIG. 14. It is seen in FIG. 18 (a bottom plan) that ribbon 168 is transported obliquely to the longitudinal axis of cartridge 65 and thus obliquely to the path of travel of tape 41 through the printing zone and obliquely to the axis of revolution of the counter wheels and time wheel 136. The ribbon 168 is wider than necessary for use if its transport were parallel to that axis of revolution. However, the oblique transport virtually eliminates use of any given portion of the ribbon for a second time. This provides a larger number of printing uses of maximum quality for a given length of ribbon and thus increases the time between replacements of cartridges.

By this construction of cartridge 65, almost all of the unused part of ink ribbon 168 is enclosed within bottom 171, transverse walls 175 and 176, walls 172 and 173, and cover 182, except for the spaces between wall 175 and both of walls 172 and 173 and the space between wall 176 and wall 173. This minimizes undesirable premature drying of unused ribbon 168.

Each of counter print wheels 66, 66A, 66B and 66C is constructed as shown in FIGS. 22 through 24. Each of these wheels has a one-piece construction having a central hole 203 for rotatable mounting on shaft 88. That wheel is a component of a wheel assembly that is used when resetting of the wheels is required. The one-piece construction suffices when the device is in the form of the second embodiment. For resetting, each of these wheels has a noncentral stepped hole 204 that is enlarged, at its larger diameter end portion, to one side to provide an adjacent deep recess 205. Extending from an outer part of that recess is a further enlargement to provide a shallow recess that extends to central hole 203. A pin 207 is secured in hole 204 with the large head of pin 207 adjacent that face of the counter wheel. Adjacent the head, a helical spring 208 is mounted on an enlarged shank portion of pin 207 with one end of spring 208 being bent and abutting a wall of deep recess 205. A pawl 209 is pivotally mounted on pin 207 between its head and spring 208. The other end of spring 208 is bent and engages pawl 209. With this construction pawl 209 is spring biased so that its distal

end is in hole 203 to abut shaft 88. The shaft 88 has a longitudinal rightangled notch 210 with a radial wall so that engagement of pawl 209 in notch 210 results in resetting by counterclockwise rotation (as viewed in FIG. 20) of shaft 88 when shaft 88 is thus rotated, but counterclockwise rotation of the counter wheel does not turn shaft 88.

Each counter print wheel has a decagonal periphery to provide ten print sides that are flat except for raised indicia comprising one of the numbers from 0 to 9 and one of 10 combinations of a set of parallel lines that are short or long to indicate by a binary code the number appearing on the same print side.

The major face of the counter wheel on which there are the recess 205 and recess 206 there is an integral gear 210 having 20 teeth with the midpoint between each set of two teeth being at the radial line passing through the center line of a print side. This gear normally meshes with a pinion 211 (FIG. 25), except for wheel 66 that is not required to have gear 210. Instead secured on that face of wheel 66 is a gear 212.

The other major face of each counter print wheel is constructed as follows as an integral part of it, although wheel 66C does not require it. That major face of the counter wheels includes a locking ring 214 with one gap having facing walls shaped to mesh with pinion 211, an intermediate two-tooth gear segment 215 in alignment with the gap and outer star gear 123 having ten teeth arranged so that their juncture is at the radial plane through the center of the corresponding print side of the decagonal periphery of the wheel.

One important aspect of the present invention is the use of a locking ring 214 with a diameter substantially larger than the outer diameter of gear 210 but a diameter sufficiently small to permit pinion 211 to mesh with gear 210, for turning the latter and thus that counter wheel when pinion 211 is meshing with and being turned by gear segment 215 of the next lower order counter wheel. For example, when gear 210 has an outer diameter of 0.955 inch, locking ring 214 can have a suitable larger diameter of 0.975 inch. This prevents ambiguity when pinion 211 is pivoted away momentarily from gear 208 as it is rotated during resetting of that counter wheel. The pivotal movement of pinion 211 away from gear 208 is insufficient for the teeth of pinion 211 to clear locking ring 214 of the next lower order counter wheel for an undesirable degree of turning of pinion 211.

The portion of each counter print wheel with the polygonal periphery has each print side rigidly supported across the full width of the radius. This insures rigidity to the print side for adequate printing quality.

The gear 214 secured on wheel 66 meshes with a gear 217 fixedly mounted on the output shaft 218 of a stepping motor 219 driven twice for short periods of time for each passage of a two-axled vehicle or a predetermined multiple number of vehicles past the vehicle counting station. The input to motor 219 is not a part of the present invention and thus is not shown in the drawings. However, a brief description is presented later. Each set of two operations of motor 219 results in advancing counter print wheel 66 by one unit.

The counter assembly 33 further includes a pinion subassembly generally indicated at 220 (FIG. 6). It includes a pinion hanger-and-guide bracket 221 that is

fixedly mounted at its ends to plates 32 and 33 above and to the left (as viewed in FIG. 6) of shaft 88 for the counter wheels and time wheel 136. It is spaced from these wheels.

The bracket 221 has an intermediate lower large recess facing to the left (as viewed also in FIG. 6). A horizontal shaft 222 is fixedly mounted in the lower portion of bracket to extend across this recess normal to plates 32 and 33. The shaft 222 has pivotally mounted on it three brackets 223 on each of which is fixedly mounted a pin 224 at a bottom clevis of bracket 223 and parallel to shaft 222. A pinion 211 is rotatably mounted on each pin 224. The pins 224 are parallel to shaft 88, as is shaft 222.

One pinion 211 is in alignment with locking ring 214 and gear segment 215 of counter print wheel 66 and gear 208 of the next higher order print wheel 66A. The second pinion 211 is similarly aligned with respect to wheels 66A and 66B and likewise for the third pinion with respect to wheels 66B and 66C.

As seen in FIG. 26, bracket 223 has, at its top portion on the other side of the hole for shaft 222, a transverse cylindrical recess 225 and a transverse oval hole 226. One end of a spring 227 is in recess 225 and the other end is in a similar recess 228 in the vertical wall at the large recess of bracket 221. A bolt 229 extends through oval hole 226 and through cylindrical tapped hole 230 (FIG. 6) through that vertical wall at that large recess. A nut 231 at the end of bolt 229 and against bracket 221 insured positioning of the head of bolt 229 to limit engagement of pinion 211 with gear 210. The spring 227 insures this degree of engagement.

As a given counter wheel begins its reset motion, it forces the associated, spring-loaded pinion 211 out of mesh to a point where the pinion jumps into the next tooth on gear 210. Although pinion 211 becomes momentarily disengaged from gear 210, it remains discreet since it does not lose contact with step-over locking ring 214 of the next lower order counter wheel, due to its larger diameter than that of gear 210. This condition is further enhanced by pivotal mounting of pinion 211 so that, when pinion 211 is pivoted out of engagement, the disengaging tooth being at a larger radius is more quickly disengaged for a given angular displacement.

Because there is the unique individual mounting of pinions 211, the pinions are never disengaged from the counter wheels. For a certain pinion it is forcibly so moved when the associated counter wheel, having its gear 211 engaging that pinion, is rotated by its reset pawl 209 being in the notch of rotating shaft 88. This construction eliminates the chance of ambiguity due to marginal pinion engagement that can be the case with a common shaft on which all pinions are rotatably mounted.

As seen in FIG. 26, each pinion 211 has alternately long teeth 232 and short teeth 233.

Referring to FIGS. 29 and 30 that disclose the present device in its embodiment as a water level monitoring and recording device it is seen that it contains many of the components described above. However, those components for resetting its shaft 88 are not required and shaft 88 need not have a longitudinal notch. The counter wheels have no need for pawl 209 and associated pin 207 and spring 208. Thus each wheel may be only the one-piece construction. The

hole 203 and recesses 205 and 206 are not required. The clutch 123, dog 125 and associated cam, gears and component 118 are not required.

Instead of stepping motor 219 with its output shaft there is a shaft 234 rotatably mounted on front vertical auxiliary plate 33 and a vertical plate 235 spaced in front of plate 33 and secured to it by standoff rods (not shown) and, if desired, to base plate 31. Fixedly mounted on shaft 234 behind plate 33 is gear 217 meshing with gear 212 on shaft 88. Fixedly mounted on shaft 234 between plates 33 and 235 is a large diameter sprocket 236 over which is trained a belt 237 having a set of longitudinally spaced holes engaging teeth of sprocket 236. A float 238 is attached to one end of belt 236. A counter weight 239 is attached to the other end of belt 236.

Using a 3.18 inch diameter sprocket (1-foot circumference) with shaft 234 geared 1:1 to shaft 88, at specified time intervals the device will print elevation of the water to the nearest 0.1 foot.

The following description applies to the especially preferred embodiment of the device of the present invention as disclosed in the drawings and described above. In that case the device is constructed to print an accumulated count at 15-minute intervals and to provide automatic resetting the counter wheels to zero every hour, with a change in the time wheel every hour.

The device is constructed for ease of service and maintenance. The mechanical components are easily accessible or replaceable. The paper tape 41, which is perforated to maintain precise print alignment, is available in rolls in which the paper tape is perforated. It is easily inserted into and removed from the device. The ink ribbon 168, as part of a disposable cartridge 65, can be positioned readily and secured by two screws 170.

A certain roll of tape 41 is available with sufficient length to provide a capacity of printing of more than 3,500 recordings. The ink ribbon 168 is available with a length that can provide nearly twice this capacity of recordings. In the illustration that follows, tape 41 has a width of 2 1/4 inches. The ink ribbon 168 has a width of five-eighths inch. During the cycle of operation obtained by operating motor 104, ribbon 168 is continuously but slowly advanced and simply yields during the very short time interval of actual printing. During this cycle with a freshly-loaded ink ribbon cartridge 65, ink ribbon 168 will advance about one-sixteenth inch as compared to an advance of seven thirty-seconds inch when the ribbon supply is almost exhausted. Thus the average ink ribbon advance is approximately one-eighth inch. The data are printed on tape 41 at approximately 1/2 inch intervals.

The openings 189 of upper shield 186 are illustratively 0.175 inch apart and the dimension of each in that direction is 0.275 inch, while the other dimension is 0.4 inch. Each print side of the decagonal periphery of the counter wheels has a length of about 0.34 inch, but only about one-half of that dimension contains the four binary code indicia. The width of that print side is 0.2 inch. In view of these dimensions of ribbon 168, the spacing between openings 189 (corresponding to the spacing of the counter wheels), and the effective area of the part of a print side containing the digital coded indicia, along with the indicated advance of ribbon

168, it is seen that, with the oblique mounting and travel of ribbon 168 at the printing zone, it is possible to perform printing effectively by a single use of a portion of the ribbon for the printing. Furthermore, in view of the dwell time between each printing there is an opportunity for the ink in the ribbon to redistribute itself for suitable use.

With the use of the device of the invention, data are recorded simultaneously in two forms: as a visually readable four character decimal numeral and a machine readable four character binary coded decimal numeral. At each printing the time is also recorded in hourly increments (1 to 24 hours).

The inputs to initiate the operation of the device for counting vehicles can be supplied through a diaphragm switch or a road loop, depending on the electrical system being used.

When a diaphragm switch is used, it is actuated by a road tube that supplies two pulses per vehicle. The count electronics provide a two to one count reduction to represent the number of vehicles. It can be constructed to provide a 20 to one count reduction if the final count is to represent 10 times the number of vehicles being counted. The count electronics also contain the necessary circuitry to drive stepping motor 219, which operates mechanical counter assembly 39.

When using the alternative to a diaphragm switch, the input is derived from a road induction loop. This input is first applied to a low current drain loop detector that supplies one pulse output for each vehicle excitation. This output is then applied to counter electronics which can, if desired, provide an output indicating ten vehicle excitations. In any event, the output by the necessary circuitry drives stepping motor 219.

In the case of the system using a diaphragm switch, it is closed when the front axle of a vehicle passes over the road tube. When the switch closes, a voltage is applied to an input monostable which generates an approximately 50-millisecond pulse. This pulse is applied to a divide-by-two flip-flop that produces one pulse out for every two pulses in, so as to account for the fact that most vehicles have two axles. The flip-flop output is connected directly to the first of two 25-millisecond monostables that drive stepping motor 219. The motor 219 requires two pulses to increment counter wheel 66 one digit, i.e., one-tenth of a complete revolution of that wheel. The output of the first monostable is coupled to the second monostable. Thus, whenever a positive pulse is received from the flip-flop (representing two diaphragm switch closures), the first monostable actuates on the leading edge, generating a 25-millisecond pulse that steps motor 219 one-half of the amount to increment counter wheel 66 one digit. The trailing edge of the first monostable output pulse in turn actuates the second monostable that steps motor 219 again with a 25-millisecond pulse to complete the turning of counter wheel 66 by one digit. Neither of these two 25-millisecond monostables is actuated on the trailing edge of the pulse from the flip-flop that represents the second axle of the vehicle and the second input to the flip-flop. The foregoing process is repeated as each vehicle passes over the road tube.

When the device is to be used with circuitry to operate stepping motor 219 to count one for every 10 vehicles, the flip-flop output is applied to a CMOS

decade counter that then drives the stepping motor monostables described above.

When using driven clock face 154, described above, that makes one complete revolution per hour and that has four magnets 157 located as described, reed switch 158 is actuated to apply a DC voltage to a print motor control monostable. The latter drives a delay and relay driver which activates motor 104 through the relay while the delay circuit inhibits the input monostable described above, during the time period that motor 104 is being driven. Typically, the time of a complete print cycle, that is, the time of operation of motor 104, requires less than one second.

During this cycle of operation of the device, shaft 88 of printer assembly 40 rotates one complete revolution during a portion of which time tape 41 is forced against ribbon 168 that is forced against counter wheels 66, 66A, 66B and 66C and time wheel 136, thereby printing the accumulated count of traffic and the time on tape 41. Before print rolls 165 are sufficiently moved in their cycle path to abut and then raise tape 41, the output of motor 104 is used to turn shaft 140 so as to move fingers 151 of correlator-and-locking assembly 143 downwardly to first correlate the counter wheels and then lock them in position so that they are not moved during the printing operation. At the same time, that there is this locking, detent lock bracket 142 pivots to lock detent 139 in position so that time wheel 136, by locking of its gear 135, is prevented from moving during the print operation.

After print rolls 165 have passed the printing station where the printing was completed, the drive mechanism operated by motor 104 no longer maintains assembly 143 in locking position. Then spring 148 causes the reverse turning of shaft 140 to raise fingers 151 and detent lock bracket 142. Before this is completed, there is a first contact of a moving lobe 119 of reset cam 120 with the cam follower of component 118 to start the release of clutch 123. The release of clutch 123 is completed shortly after correlator-and-locking assembly 143 has moved out of locking position.

When clutch 123 is thus released, the double rotation of shaft 88 is initiated. During the second rotation of shaft 88, tape 41 is advanced by the pivotal movement of arm 72 to provide turning of shaft 56 and shaft 51. The indexing of time wheel 136 occurs during this advance of tape 41. This indexing occurs through the turning movement of finger 94 with the rotation of shaft 88 to turn time indexing wheel 132 for simultaneous turning of indexing cam 134 meshing with gear 135 on wheel 136.

During this entire cycle of operation provided by one interval of operation of motor 104, gear 109 is driven and through gear 110 and roller 113, takeup spool 115 is thereby turned to continually advance ribbon 168.

The foregoing description relates to an entire cycle of operation including a resetting of the counter wheels. Of course, the release of clutch 123 with the resultant double revolution of shaft 88 for resetting does not occur for a cycle of operation that is merely a printing operation with advance of ribbon 168 and advance of paper tape 41. The advance of wheel 136 only occurs with this resetting of the counter wheels and that occurs every fourth printing operation for the device as described.

When the especially preferred embodiment of the device is to be used for cumulative counting with periodic printing but without resetting of the counter wheels, reset gear 93 is made inoperative. This is done by removing the screws that fixedly mount adjust bracket 90 on shaft 88. Thus the device, as modified by rotatably mounting bracket 90, can be used for monitoring elevation or level of a river or the like. The stepping motor 219 and its shaft would be replaced by sprocket 236 with its shaft 234, belt 237, float 238, counterweight 239, and plate 235 as shown in FIGS. 29 and 30.

The foregoing description of two embodiments of the device of the invention has been presented for illustration purposes. The present invention is limited only by the claims that follow.

I claim:

1. A recording device, which comprises:

a rigid support assembly including:

a base plate;

a rear vertical main plate fixedly mounted on the base plate;

a front vertical auxiliary plate fixedly mounted on the base plate and parallel with but spaced from the main vertical plate; and

means secured to said vertical plates to maintain them in fixed spaced relationship;

a counter assembly including:

a horizontal shaft rotatably mounted on and between said vertical plates at a printing zone;

a set of counter print wheels rotatably mounted on said shaft;

a pinion subassembly including pinions, each engageable with a pair of adjacent counter print wheels to step the count from one counter print wheel to the adjacent higher order counter print wheel;

means to turn one counter wheel of the set of counter print wheels in response to a change in a condition;

a printer assembly mounted on said rigid support assembly between said vertical plates, including:

a printing component; and

a support for said printing component mounted for movement from a normal position at which said printing component is spaced from said counter print wheels to a printing position for said printing component at the printing zone and for return to the normal position;

power-driven means mounted on said rigid support assembly to provide at predetermined intervals said movement of said support for said printing component for a printing operation;

power-driven means mounted on said support assembly to advance a printable tape periodically in a horizontal path of travel through the printing zone, parallel to said vertical plates and between said counter print wheels and said printer assembly after the printing operation;

means mounted on said support assembly to support the tape at a horizontal plane before passage of the tape below said counter print wheels;

means mounted on said support assembly to support the tape at a horizontal plane after passage of the tape below said counter print wheels;

an ink ribbon cartridge mounted on said support assembly and containing:

a casing having a bottom opening at one end portion of said casing and at the printing zone;
an ink ribbon;

a supply spool rotatably mounted on said casing spaced from said end portion and on which a part of said ribbon is wound;

a takeup spool rotatably mounted on the casing spaced from said end portion and on which another part of said ribbon is wound; and

guide means as an integral part of and adjacent said one end of said cartridge to direct an intermediate unwound part of said ribbon at said one end of said cartridge and extending between said spools, in a manner such that a printing surface of that part of said ribbon is at the printing zone below said counter print wheels and extends horizontally across said bottom opening and normal to but spaced from the path of travel of the printable tape; and

power-driven means mounted on said rigid support assembly and operatively engageable with said takeup spool to advance said ribbon periodically in association with the printing operation and the advance of the tape.

2. The recording device of claim 1 wherein said ink ribbon cartridge further includes a pair of horizontal thin resilient shields mounted on said casing and extending over said bottom opening, said ink ribbon at the printing zone being between said shields, and said shields each having a set of openings in alignment with each other and in alignment with said counter wheels.

3. The recording device of claim 2 wherein:

said printing component comprises:

a set of print rolls;

a set of horizontal print roll shafts rotatably mounting said print rolls; and

a set of print rolls brackets mounting said shafts for said print rolls; and

said support for moveable mounting of said printing component comprises:

a horizontal print assembly shaft mounted on said vertical plates;

a support bracket fixedly mounted on said print assembly shaft between said vertical plates and having a number of extensions supporting said set of print roll shafts pivotally mounting said print roll brackets between said extensions;

a set of springs mounted on said printing component bracket and engaging said set of print roll brackets to bias said set of print rolls away from the axis of said print assembly shaft; and

means limiting said pivotal movement of said print rolls away from the axis of said print assembly shaft; and

said power-driven means providing said movement of said support for said printing component being operatively associated with said print assembly shaft to rotate it one complete revolution for each printing operation whereby the set of print rolls in a cyclic path of movement are moved through an arc that raises said tape and overlying ribbon to said counter wheels for the printing.

4. The recording device of claim 3 wherein:

said casing and said guide means of said ink ribbon cartridge comprise:

a one-piece component having:

a horizontal bottom;

an end wall at one end of the said bottom;

front and rear walls extending from said end wall to beyond the other end of said bottom;

a transverse wall extending between said front and rear walls but spaced a short distance from them at said other end of said bottom;

an intermediate transverse wall on an intermediate part of said bottom and extending from said front wall to, but spaced from, said rear wall;

a vertical spindle extending upwardly from said bottom between said transverse walls and rotatably mounting said supply spool;

a vertical spindle extending upwardly from said bottom between said intermediate transverse wall and said end wall and rotatably mounting said takeup spool;

a raised horizontal platform extending from said transverse wall at said other end of said bottom, with said platform having its longitudinal edges parallel to but spaced from said extensions of said front and rear walls except at the distal end of said platform, and said platform having said bottom opening; and

a cover mounted on said one-piece component, said extension of said front and rear walls having opposed thinner portions to provide vertical recesses at their outer faces and having at said portions downwardly inclined top edges and rectangular notches at the bottom to provide said guide means, whereby said ink ribbon from said supply spool extends beyond said transverse wall between said platform and said front wall to said inclined top surface, over said surface to extend downwardly to said notch, over said notch, upwardly on the rear side of said front wall extension to the top of said platform, across said platform at said bottom opening, downwardly between said platform and said rear wall extension, around said rear wall extension at said notch, over said inclined top surface of said rear wall, over it, then horizontally to between said rear wall and said transverse walls to said takeup spool,

said takeup spindle being offset toward said rear wall, and

said rear wall having a gap and said bottom and cover having an arcuate notch to permit periphery of discs of said takeup spool to be frictionally engaged by said power-driven means to advance said ribbon by turning said takeup spool.

5. The recording device of claim 4 wherein:

counter print wheels of said counter assembly have a one-piece construction for each including:

a median portion with a polygonal peripheral surface to provide print side portions, each having radial support across its entire width intermediate its length;

one face having a gear meshing with one of said pinions;

the other face being stepped and having:

an outer star gear having the same number of teeth as said number of peripheral side portions with each tooth of said star gear at the radial line through the juncture between side portions:

a two-tooth gear segment; and

a locking ring having a diameter sufficiently larger than the diameter of said gear on said one face of said wheel to prevent free rotation of said pinion when it is jumped out of contact with said gear on said one face of the adjacent counter print wheel when that adjacent wheel is turned relative to said locking ring, but the diameter of said locking ring is sufficiently small to permit step-over turning of said adjacent wheel by said associated pinion; and said pinion subassembly being constructed to mount each of said pinions on a shaft mounted on a pinion bracket individually mounted for pivotal movement of each pinion during its said jumping out of contact.

6. The recording device of claim 5 and further including a correlator-and-locking assembly for said counter print wheels, that includes:

- a correlator-and-locking shaft rotatably mounted on said vertical plates;
- a bracket fixedly mounted on said correlator-and-locking shaft and having fingers extending therefrom, each with a distal V-shaped bottom portion, in a number corresponding to the number of said counter print wheels and in alignment with said counter print wheels, with a normal position of that bracket being that at which said fingers are spaced from said counter wheels but moveable to a position at which said V-shaped portions of said fingers engage said star gears for correlating the position of said counter print wheels and then to a lower position in engagement with said star gears to lock said wheels against turning movement;
- power-driven means to turn said correlator-and-locking shaft to move said fingers downwardly to locking position; and
- means to reverse movement of said correlator-and-locking shaft to said normal position.

7. The recording device of claim 6 wherein:

- said casing of said ink ribbon cartridge has thickened corners at the juncture of said end wall and said front wall and at the juncture of said end wall and said rear wall, each of said corners having a vertical hole through it, and has aligned holes in said cover;
- said cartridge being mounted on said support assembly by:
 - a bracket fixedly mounted on said rear vertical plate and having threaded holes on it; and
 - screws passing through said holes in said cover and said holes at said thickened corners and secured to said bracket having said threaded holes to securely support said cartridge at one end;
- said means to support the tape at a horizontal plane before passage of the tape below said counter print wheels comprises:
 - a U-shaped bracket having upstanding legs fixedly mounted at its legs on said front and rear vertical plates, said legs being thinner at their upper portion to provide outer horizontal ledge support surfaces;
 - a shaft rotatably mounted on said legs with its axis normal to said vertical plates; and
 - a tape supply sprocket fixedly mounted on said shaft mounted on said legs, said sprocket having

- a cylindrical configuration with sprocket teeth around it, at a vertical plane parallel to said vertical plates and passing between adjacent counter print wheels, to engage perforations longitudinally spaced in the tape;
- said raised platform of said cartridge having a slot parallel to said front and rear walls;
- said extensions of said front and rear walls supported on said horizontal ledge support surfaces of said legs of said U-shaped bracket to provide support of said cartridge at its other end with said platform being closely above said sprocket with said slot in said platform providing clearance for said sprocket teeth;
- said means to support the tape at a horizontal plane after passage of the tape below said counter print wheels includes a horizontal desk mounted on and between said vertical plates;
- said tape-advance power-driven means includes:
 - a drive capstan sprocket having a cylindrical configuration with sprocket teeth around it; and
 - a shaft rotatably mounted on and between said vertical plates and fixedly mounting said capstan sprocket with its teeth in alignment with those of said supply sprocket;
 - a takeup spool on which the tape can be wound; and
 - means to rotate said capstan sprocket and said takeup spool.
- 8. The recording device of claim 7 wherein:
 - said means to turn one of said counter print wheels in response to a change in condition comprises:
 - a gear secured on a face of said one counter print wheel to turn that wheel when that gear is turned;
 - a driving gear meshing with said gear secured on said one counter print wheel;
 - another shaft rotatably mounted on said front vertical plate and on which said driving gear is fixedly mounted; and
 - means to turn said another shaft in response to said condition change.
- 9. The recording device of claim 7 wherein:
 - said another shaft and said means to turn said another shaft in response to a change in condition comprise a stepping motor with said another shaft being its output shaft;
 - said shaft rotatably mounting said counter print wheels having a longitudinal notch at the location of said set of wheels;
 - each counter print wheel having, in addition to its central hole for rotation on said notched shaft, a noncentral stepped hole with its large diameter end portion at the side having said gear meshing with one of said pinions, said large diameter end portion being enlarged to one side to provide an adjacent deep recess and further enlarged as a shallow recess extending to the central hole;
 - said counter assembly further including:
 - a pin with a large head and adjacent enlarged shank securely mounted in each noncentral hole of said wheels;
 - a helical spring mounted on the enlarged shank of each pin with the ends of said spring being bent and with one bent end engaging the wall of said deep recess; and

a pawl mounted on each pin between said head and said spring and extending into said shallow recess with the other bent end of said spring biasing the distal end of said pawl into said central hole to be engaged in said notch of said shaft when the latter is rotated for resetting of said wheels; and

said device further including:

power-driven means operatively associated with said notched shaft to provide two revolutions of said notched shaft for resetting of each counter print wheel after a predetermined number of printing operations and constructed to provide the two revolutions after a printing during the completion of the single revolution of said horizontal print assembly shaft, said power-driven means for said notched shaft, when operating, being driven by said power-driven means for said one complete revolution of said printing component.

10. The recording device of claim 9 wherein:

said power-driven means to advance said ribbon includes:

a roller frictionally engaging said discs of said takeup spool of said cartridge;
a vertical shaft on which said roller is fixedly mounted;
a gear fixedly mounted on said vertical shaft;
a bracket mounted on said rear plate and rotatably mounting said vertical shaft;
motor means having first and second output shafts and mounted on said support assembly;
a gear fixedly mounted on one of said output shafts and meshing with said gear mounted with said roller on said vertical shaft;
a cam fixedly mounted on said one output shaft;
switch means mounted to be engaged by said cam means to stop said motor means; and
gear means operatively associated with and between the other output shaft of said motor means and said horizontal print assembly shaft to constitute, upon operation of said motor means, said power-driven means to rotate that print assembly shaft a single revolution for a printing operation; and

said recording device further includes:

a switch mounted on the support assembly to initiate operation of said motor means; and
clock-operated means mounted on the support assembly to operate said switch at said predetermined intervals to initiate operation of said motor means to advance said ribbon and to provide one revolution to said horizontal print assembly shaft.

11. The recording device of claim 10 wherein:

said tape-advance power-driven means includes:

a support shaft;
a follower arm pivotally mounted on that support shaft;
a cam fixedly mounted on said horizontal print assembly shaft;
a link connected at one end to said follower arm; and
a ratchet assembly mounted on said shaft of said capstan sprocket and including:

an arm having an intermediate opening by which that arm is rotatably mounted on said capstan sprocket shaft and having one end pivotally connected to the other end of said link;

a ratchet wheel fixedly mounted on said capstan sprocket shaft;

a pawl mounted on said arm on said capstan sprocket shaft and engaging said ratchet wheel to turn it upon movement of said link by said cam moving said follower arm; and

a locking pawl pivotally mounted at a fixed axis on said support assembly and engaging said ratchet wheel to prevent reverse movement of it.

12. The device of claim 11 wherein said takeup spool for the tape is driven with turning of said capstan sprocket by said ratchet assembly including:

a pulley fixedly mounted on said takeup spool for the tape;

a pulley fixedly mounted on said capstan sprocket shaft; and

a belt trained about said pulleys.

13. The device of claim 9 wherein said power-driven means operatively associated with said notched shaft of said counter assembly includes:

a further shaft fixedly mounted on said rear vertical plate and parallel to and adjacent said notched shaft of said counter assembly and said horizontal print assembly shaft;

a clutch rotatably mounted on said further shaft and having a spring-loaded clutch key and an integral gear;

a clutch dog rotatably mounted on said further shaft and having an integral gear;

a gear fixedly mounted on said horizontal print assembly shaft and meshing with said gear of said dog;

a compound gear fixedly mounted on said horizontal print assembly shaft and including a gear driven for rotation of that shaft and an integral finger;

a cam on said further shaft to be turned by said finger one position for each revolution of said compound gear, said cam having at least one integral lobe;

a cam follower and clutch detent arm component rotatably mounted on said horizontal print assembly shaft and being spring-biased toward said further shaft, said clutch detent arm disengaging said clutch key until said cam follower of that component being moved by engagement by said lobe of said cam when being moved by said finger of said compound gear; and

a gear fixedly mounted on said notched shaft of said counter assembly and meshing with said gear integral with said clutch, with these meshing gears of such relative size that there are two revolutions of said notched shaft to one revolution of said clutch; said gear integral with said clutch dog and said gear meshing with it being of such relative size that said clutch when engaged is rotated a complete revolution during only a part of a single revolution of said horizontal print assembly shaft, and said lobe being located on said cam to cause turning of said component for engagement of said clutch after said print rolls have caused a printing.

14. The recording device of claim 13 and further including:

a time wheel rotatably mounted on said notched shaft of said counter assembly, said time wheel having an integral gear on one face and a polygonal periphery with 24 print sides;

a detent rotatably mounted intermediate its length on said correlator-and-locking shaft with the detent end downwardly against said integral gear of said time wheel to prevent its free turning;

a detent lock bracket fixedly mounted intermediate its length on correlator-and-locking shaft with one arm above the detent end to be moved downwardly to lock said detent in position against said gear of said time wheel when said correlator-and-locking shaft is turned to locking position;

a spring connected to the other end of said detent and the other end of said detent lock bracket to urge said detent in position to prevent time wheel free turning;

a stub shaft rotatably mounted on said support assembly;

an indexing cam rigidly mounted on said stub shaft to engage said integral gear of said time wheel so as to turn said time wheel one position for each predetermined number of printing operations;

a time indexing wheel fixedly mounted on said stub shaft; and

an integral gear and finger rotatably mounted on said notched shaft and being driven by said power-driven means for said horizontal print assembly by one revolution for each.

15. The recording device of claim 9 wherein: said individual mounting of said pinions of said pinion subassembly comprises:

a support bracket fixedly mounted at its ends on said vertical plates and having an intermediate lower recess;

a shaft mounted in the lower portion of that support bracket and extending across that recess;

pinion brackets pivotally mounted on that shaft and extending downwardly;

a pinion shaft for each pinion bracket;

said pinions being rotatably mounted on said pinion shafts;

spring means for each pinion bracket to urge the pinion toward said pair of adjacent counter print wheels; and adjustable means for each pinion bracket to limit pivotal movement of the pinion away from said pair of adjacent counter print wheels.

16. The recording device of claim 7 wherein: said means to turn one of said counter print wheels in response to a change in condition comprises:

a gear secured on a face of said one counter print wheel to turn that wheel when that gear is turned;

a driving gear meshing with said gear secured on said one counter print wheel;

another shaft rotatably mounted on said front vertical plate and on which said driving gear is fixedly mounted;

a sprocket fixedly mounted on said another shaft; and

counterweighted float means engaging said sprocket on said another shaft to turn that sprocket, that another shaft, and at least said one counter print wheel in one of its two directions in response to sufficient change in liquid elevation sensed by said float means.

17. The recording device of claim 4 wherein said vertical recesses with inclined top edges and bottom notches of said extensions of said front and rear walls are offset with respect to each other to provide an oblique passage of said ribbon between said two shields and with respect to the axis of rotation of said counter print wheels.

18. An ink ribbon cartridge for a recording device which comprises:

a casing having a bottom opening at one end portion of said casing and at the printing zone;

an ink ribbon;

a supply spool rotatably mounted on said casing spaced from said end portion and on which a part of said ribbon is wound;

a takeup spool rotatably mounted on the casing spaced from said end portion and on which another part of said ribbon is wound; and

guide means as an integral part of and adjacent said one end of said cartridge to direct an intermediate unwound part of said ribbon at said one end of said cartridge and extending between said spools, in a manner such that a printing surface of that part of said ribbon extends horizontally across said bottom opening; and

a pair of horizontal thin resilient shields mounted on said casing and extending over said bottom openings, said shields each having a set of openings in alignment with each other.

19. The cartridge of claim 18 wherein said casing and said guide means comprise:

a one-piece component having:

a horizontal bottom;

an end wall at one end of the said bottom;

front and rear walls extending from said end wall to beyond the other end of said bottom;

a transverse wall extending between said front and rear walls but spaced a short distance from them at said other end of said bottom;

an intermediate transverse wall on an intermediate part of said bottom and extending from said front wall to, but spaced from, said rear wall;

a vertical spindle extending upwardly from said bottom between said transverse walls and rotatably mounting said supply spool;

a vertical spindle extending upwardly from said bottom between said intermediate transverse wall and said end wall and rotatably mounting said takeup spool;

a raised horizontal platform extending from said transverse wall at said other end of said bottom, with said platform having its longitudinal edges parallel to but spaced from said extensions of said front and rear walls except at the distal end of said platform, and said platform having said bottom opening; and

a cover mounted on said one-piece component,

said extension of said front and rear walls having opposed thinner portions to provide vertical recesses at their outer faces and having at said portions downwardly inclined top edges and rectangular notches at the bottom to provide said guide means; whereby said ink ribbon from said supply spool extends beyond said transverse wall between said platform and said front wall to said inclined top surface, over said surface to extend downwardly to

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said notch, over said notch, upwardly on the rear side of said front wall extension to the top of said platform, across said platform at said bottom opening, downwardly between said platform and said rear wall extension, around said rear wall extension at said notch, over said inclined top surface of said rear wall, over it, then horizontally to between said rear wall and said transverse walls to said takeup spool,
 said takeup spindle being offset toward said rear wall, and

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said rear wall having a gap and said bottom and cover having an arcuate notch to permit periphery of discs of said takeup spool to be frictionally engaged for turning of said takeup spool to advance said ribbon.

20. The cartridge of claim 19 wherein said vertical recesses with inclined top edges and bottom notches of said extensions of said front and rear walls are offset with respect to each other to provide an oblique passage of said ribbon between said two shields.

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