United States Patent [19]

Digney

[11] **3,838,430**

[45] **Sept. 24, 1974**

[54] **PRINTING APPARATUS FOR MULTIPLE-POINT RECORDER WITH SELECTABLE NUMBER PRINTING**

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[73] Assignee: **Honeywell Inc.**, Minneapolis, Minn.

[22] Filed: **Mar. 29, 1973**

[21] Appl. No.: **346,136**

Related U.S. Application Data

[63] Continuation of Ser. No. 215,476, Jan. 5, 1972, abandoned.

[52] **U.S. Cl.** **346/61**, 197/55, 346/141

[51] **Int. Cl.** **G01d 15/20**, G01d 9/34

[58] **Field of Search** 346/34, 61, 141; 197/55, 197/18, 16

[56] **References Cited**

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Primary Examiner—Joseph W. Hartary
Attorney, Agent, or Firm—Arthur H. Swanson; Lockwood D. Burton; John Shaw Stevenson

[57] **ABSTRACT**

An improved print mechanism for a plural-function recorder having a single record receiver includes a continuously orbiting rod and a plurality of print wheels each of which has a plurality of marking elements on the periphery thereof. The orbiting rod operates successively and repetitively to effect joint step-by-step angular synchronous adjustments of said print wheels to bring each of said marking elements, in turn, into a position for marking said record receiver. The orbiting rod also actuates said print wheels, when so adjusted, into and out of firm marking engagement with said record receiver. Recording in different modes selectively may be effected by a manual adjustment which permits relative axial displacement of said print wheels and thereby printing by one only or both of said print wheels continuously, or by one continuously and the other intermittently.

16 Claims, 15 Drawing Figures

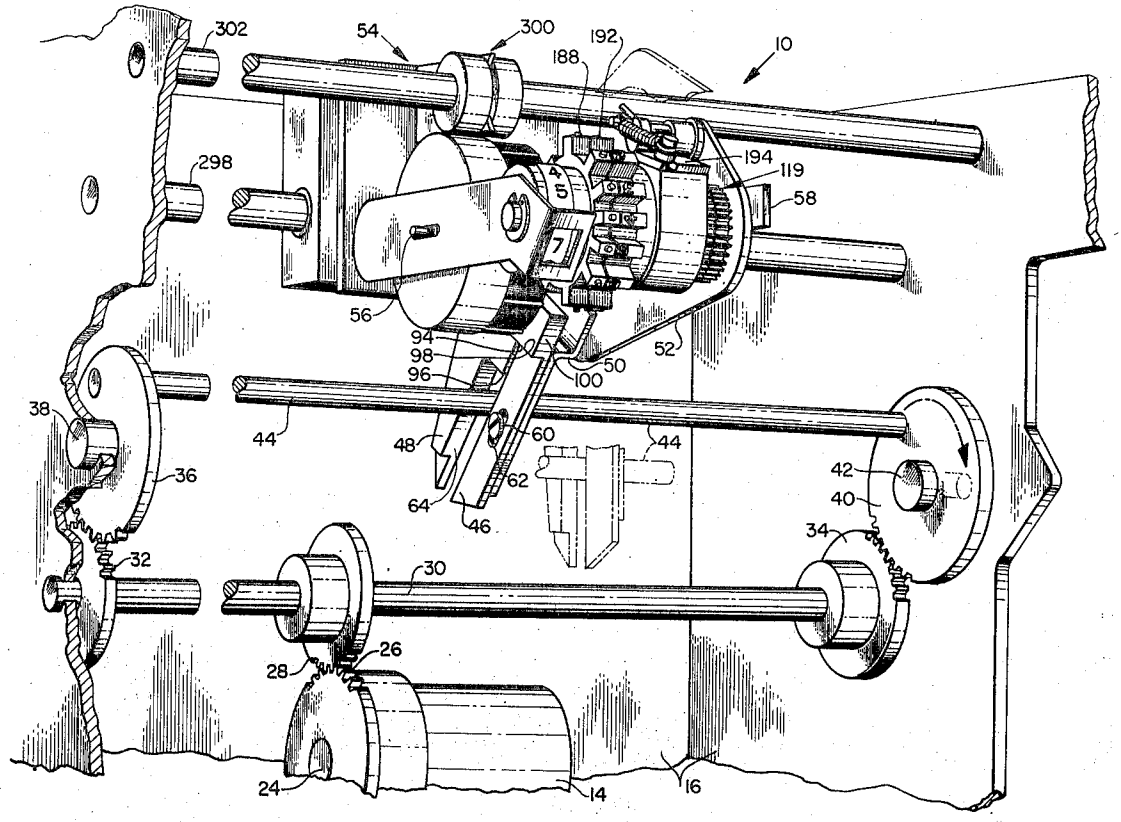
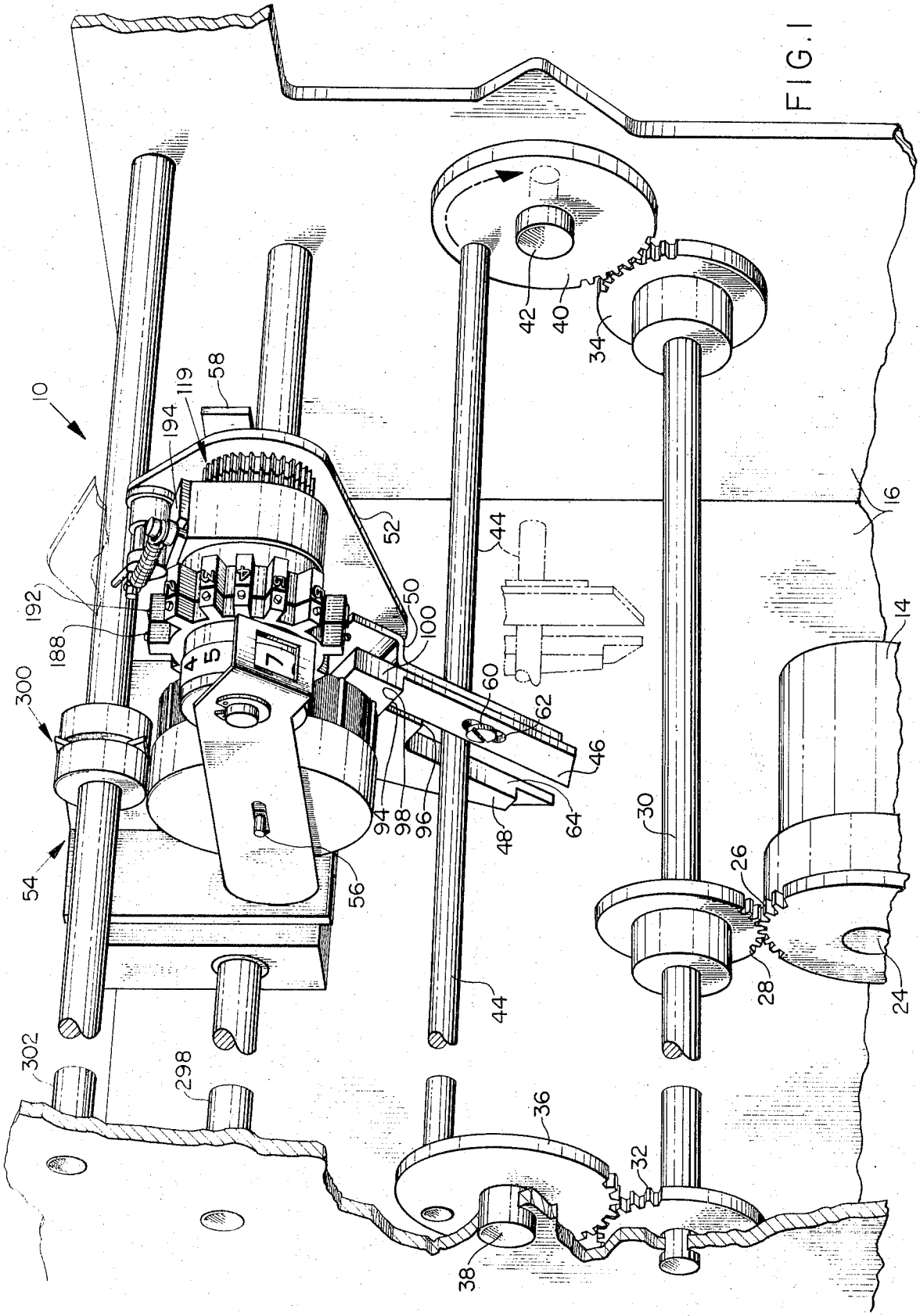


FIG. 1


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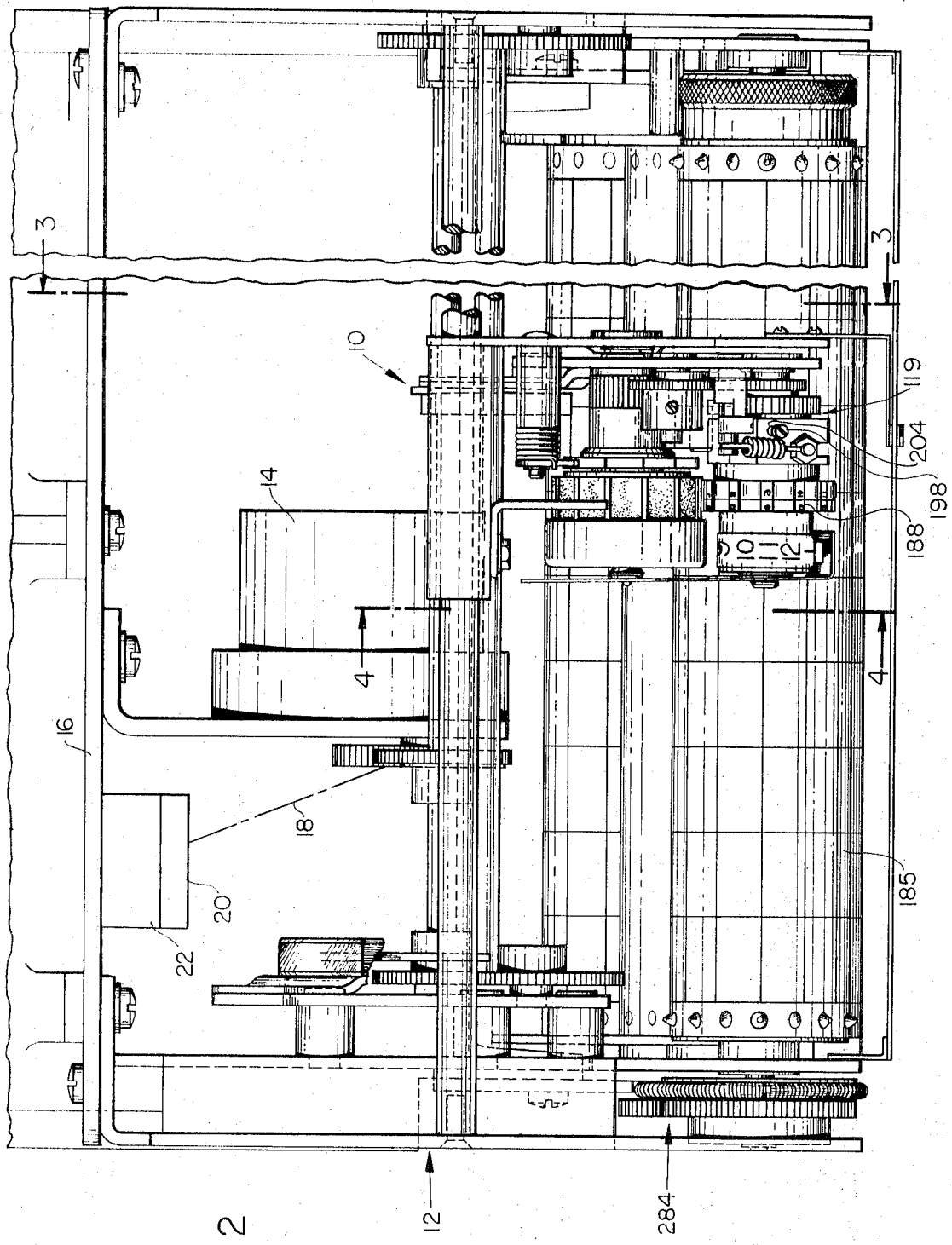


FIG. 2

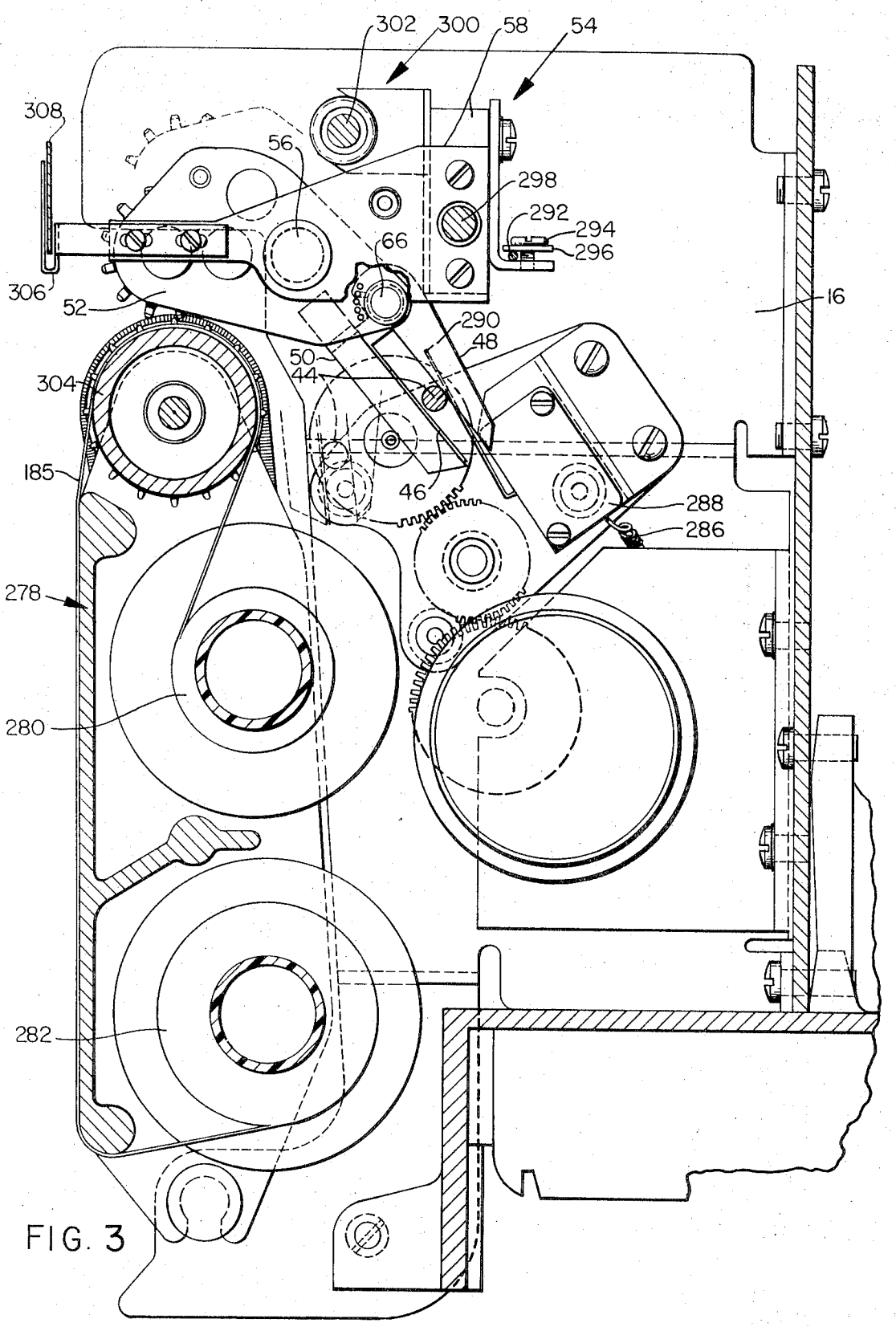

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FIG. 3

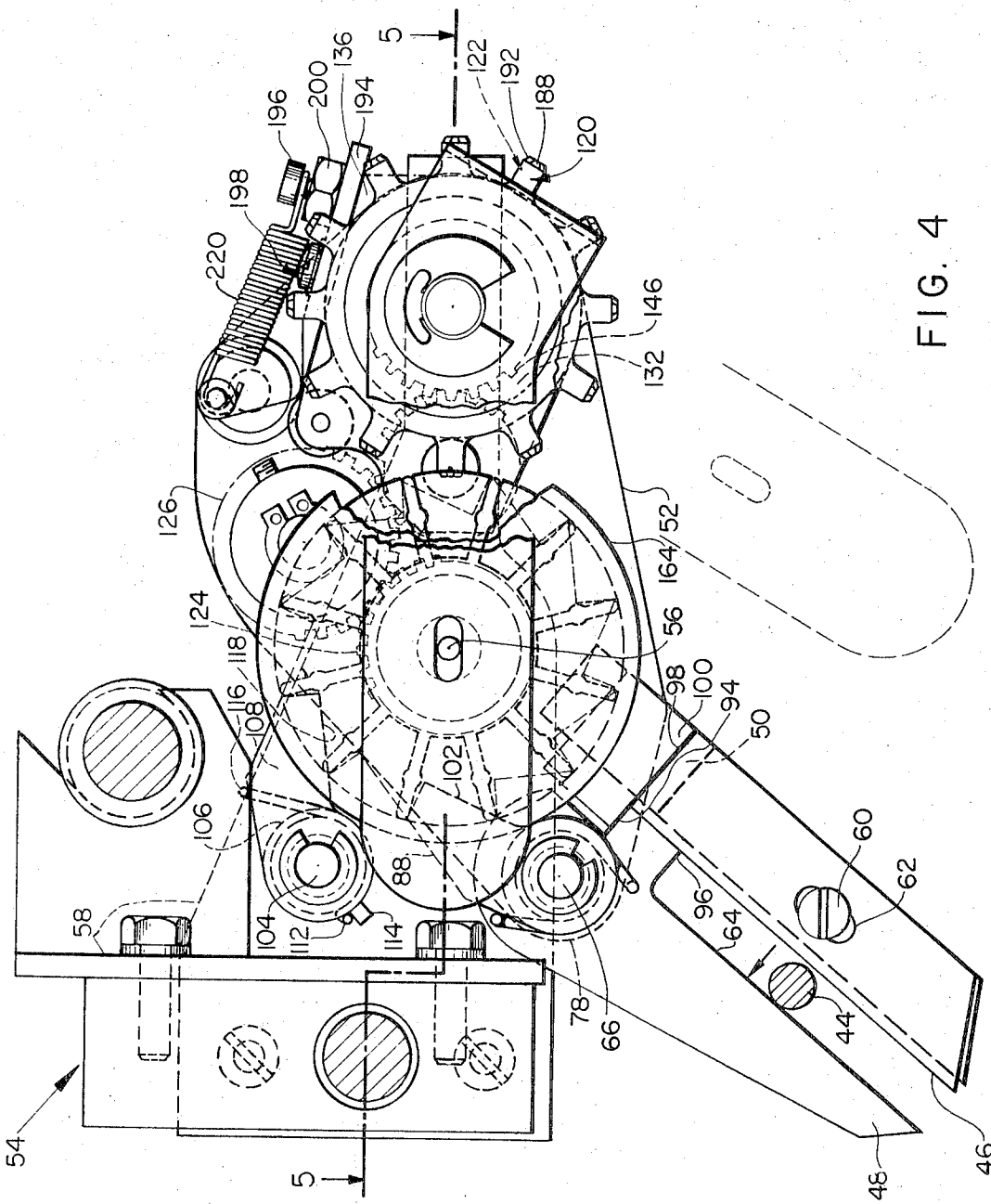
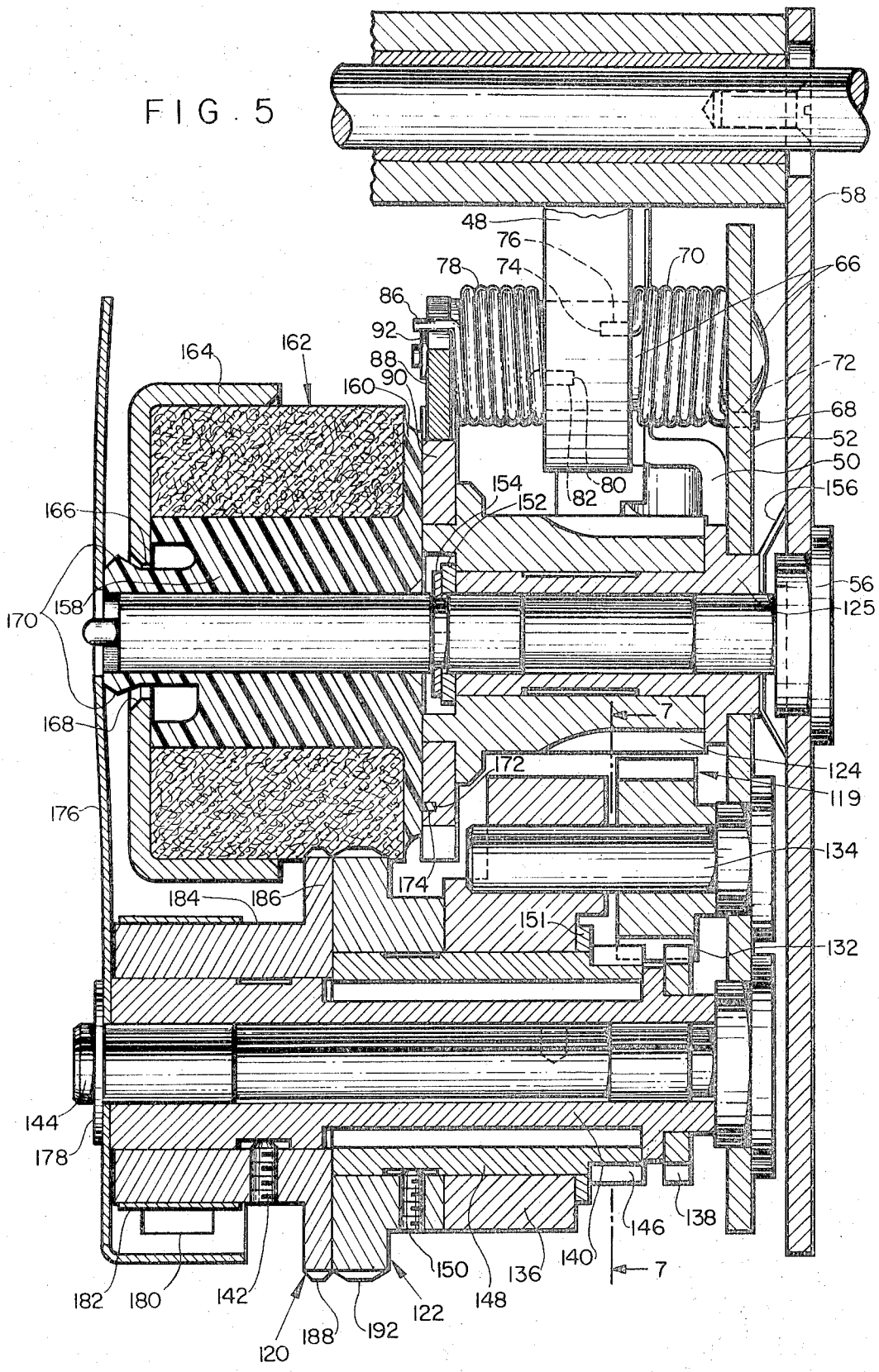

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FIG. 4

FIG. 5


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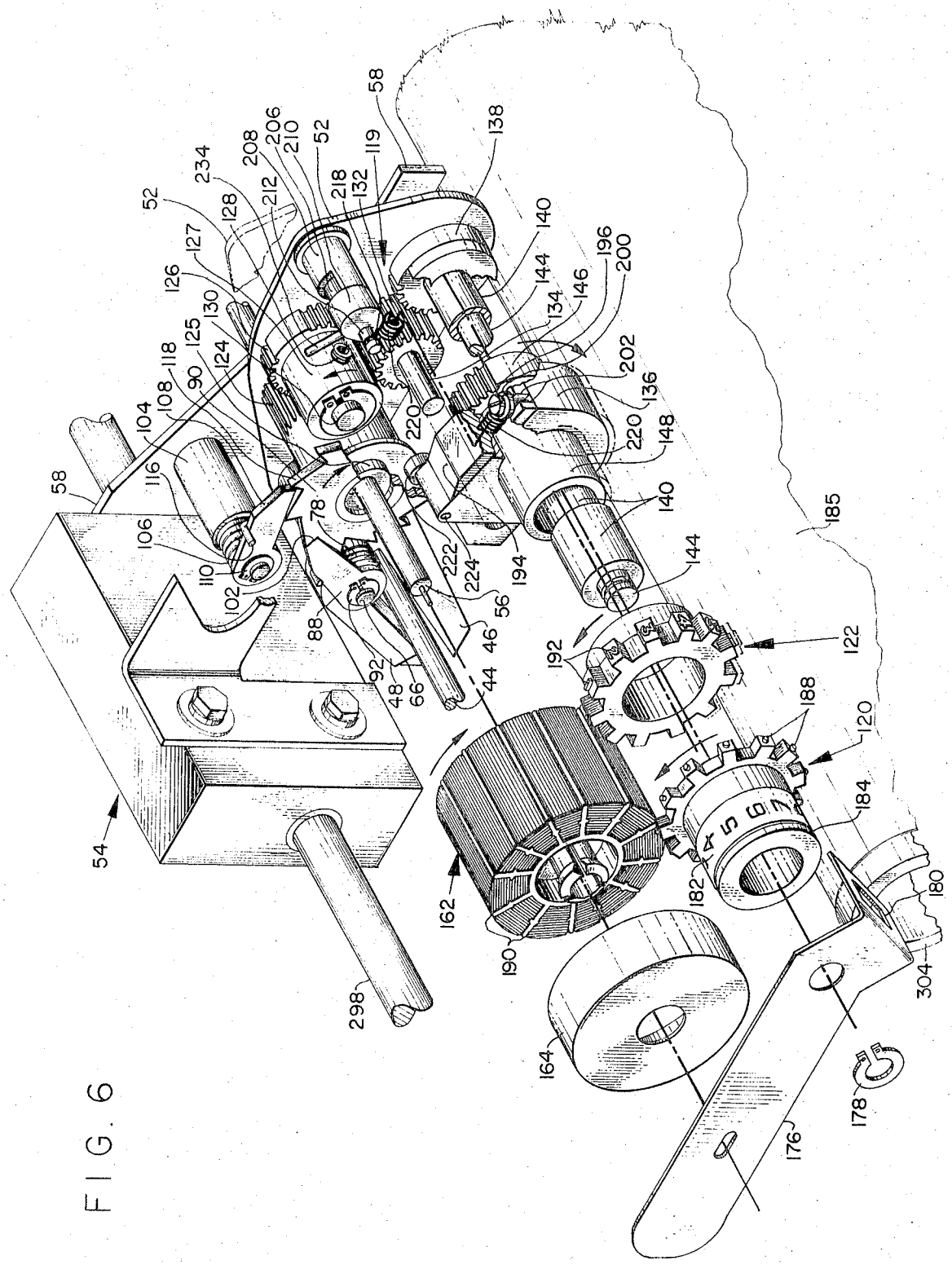

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FIG. 6

FIG. 7

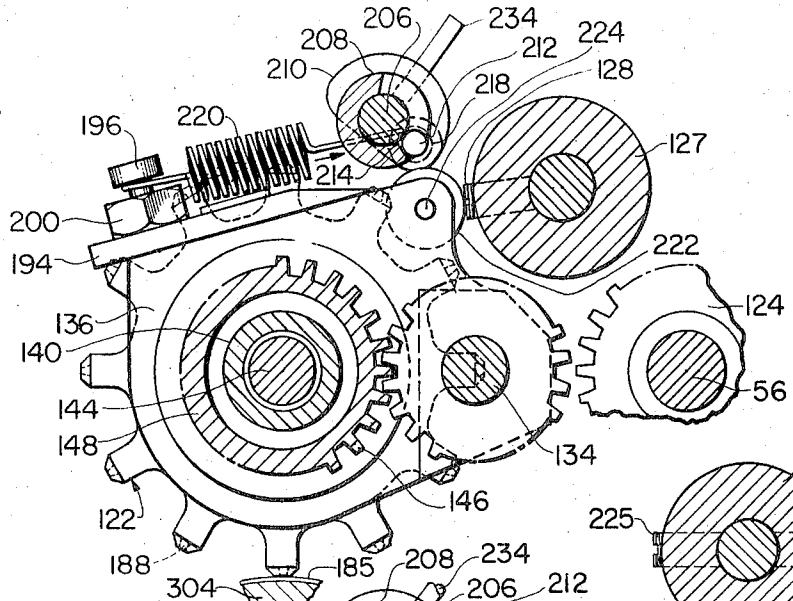


FIG. 9

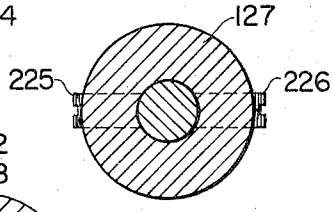


FIG. 8

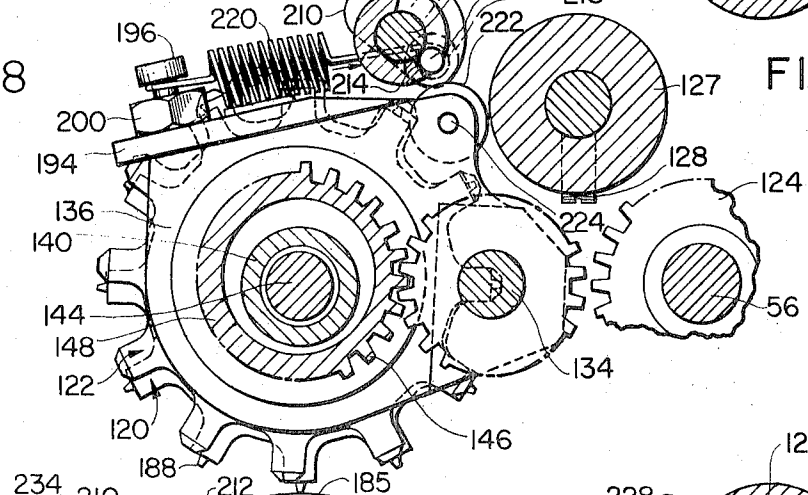


FIG. 10

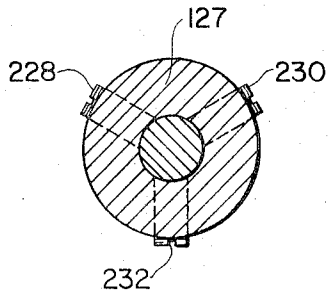
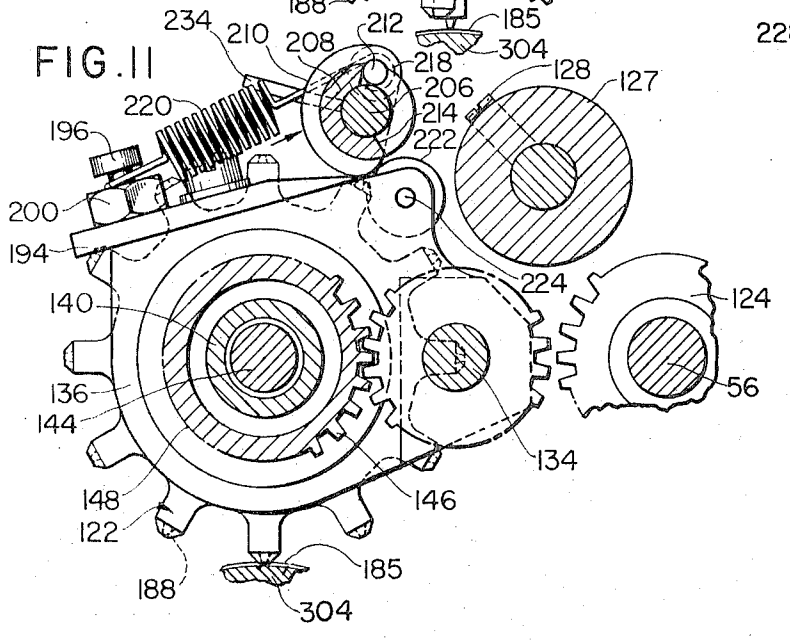


FIG. 11



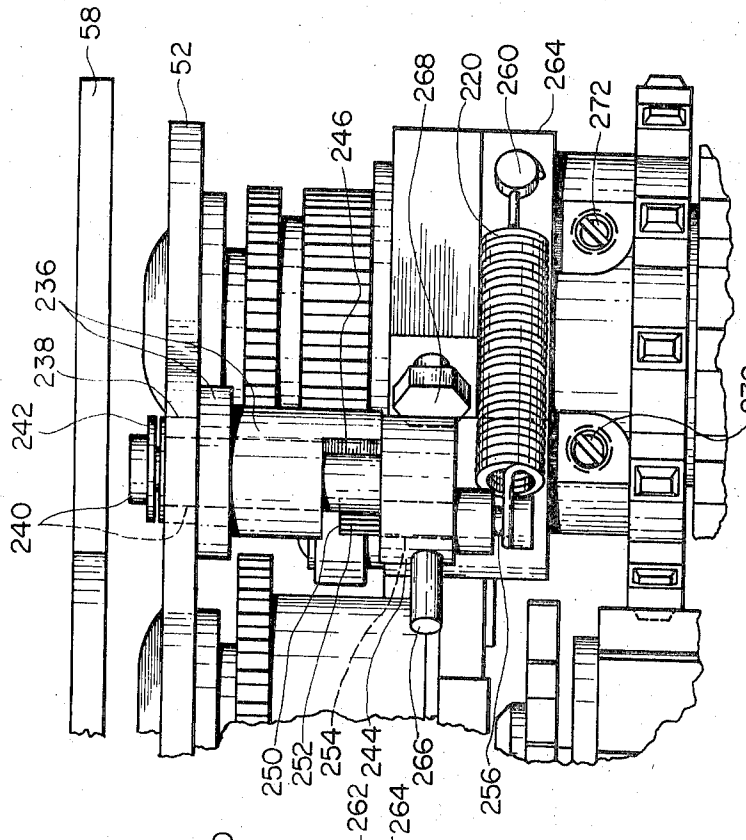

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FIG. 13

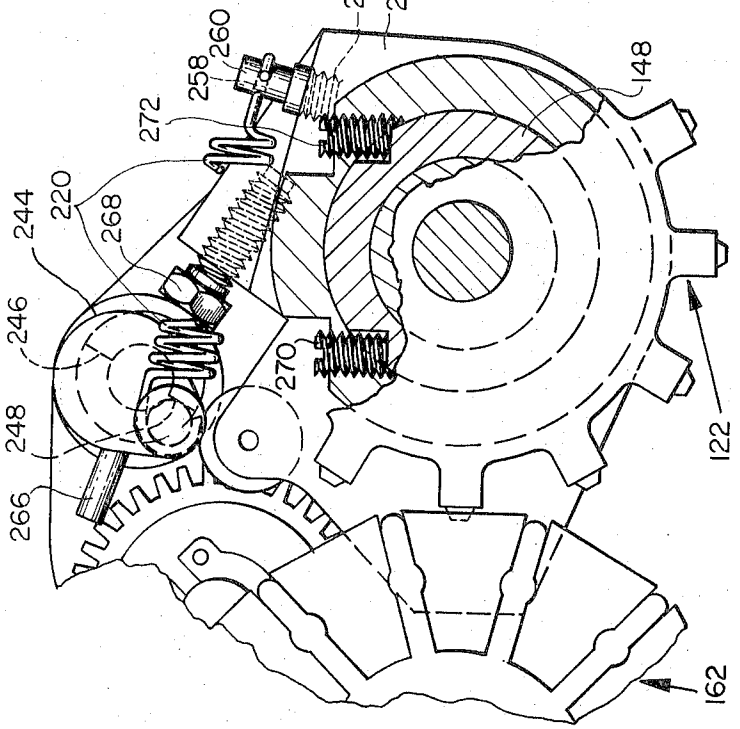

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FIG. 12

FIG. 15

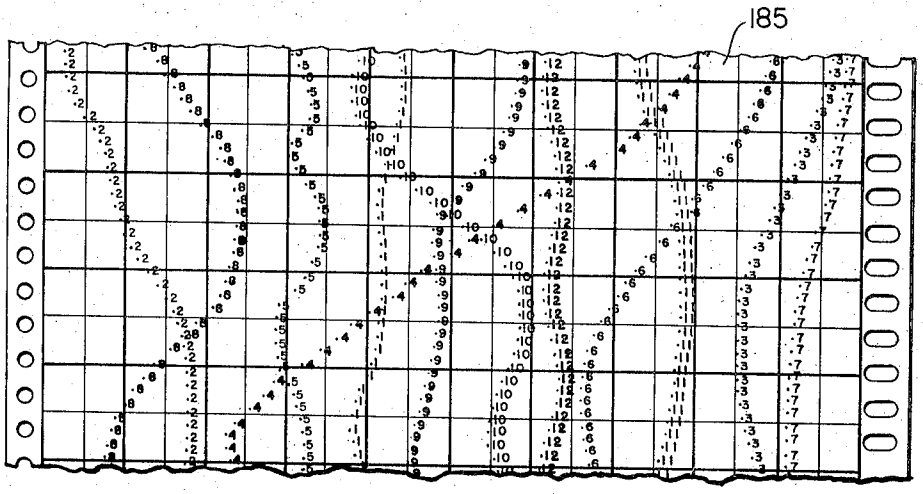
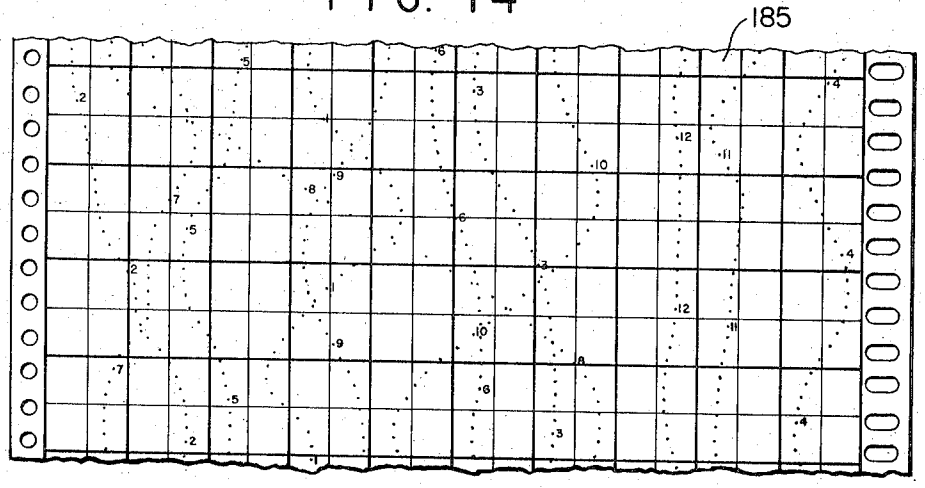


FIG. 14



PRINTING APPARATUS FOR MULTIPLE-POINT RECORDER WITH SELECTABLE NUMBER PRINTING

This application is a continuation of my prior application bearing Ser. No. 215,476, now abandoned filed Jan. 5, 1972.

BACKGROUND OF THE INVENTION

1. Field of the Invention

Applicant's invention is for an improved print mechanism for a plural-function recorder of the type generally classified in the U.S. Patent Office with Plural-Function Recorders, Distinguishable Recordings, Plural Markers and Single Record Receiver, with Register Character Recorder or similar apparatus.

2. Description of the Prior Art

Print mechanism embodying record-distinguishing means for plural-function or multiple point strip chart recorders have been known and employed in the industry for many years. Such print mechanisms generally have operated in a single mode, identifying each quantity under measurement by a characteristic mark or color. More recently there has been a demand for more sophisticated forms of print mechanism which are operative to provide several different modes of printing. Such print mechanisms provide records comprising different colored marks or dots the positions of which on the strip chart are indicative of the magnitude of the value of each measured quantity. Selectively, such print mechanisms may be adjusted to provide records comprised of dots and periodically a record identification number beside a dot. This permits ready identification of the individual curves or traces which are formed by the related series of recorded dots from each of the quantities under measurement. Alternatively, by a different adjustment of the print mechanism, effected manually, each one of the dots representing a quantity under measurement may have printed beside it a record identification number.

Several forms of the prior printing mechanisms are illustrated in U.S. Pat. Nos. 3,195,141, 3,316,554 and 3,317,913. Each of these prior printing mechanisms employ a single print wheel having a plurality of dot marking elements on one peripheral portion thereof and a plurality of numeral marking elements on another peripheral portion. With such mechanisms, when a dot and identifying numeral are to be printed simultaneously, the print wheel, in its marking operations is held with both of its peripheral portions squarely facing the chart. When a dot only is to be printed, the wheel must first be tilted to a precise angle with respect to the chart so that a dot marking element then only is in position to make a mark. When a numeral is intermittently to be printed to identify the curve formed by a series of dots, the print wheel must first be tilted back to its position in which both dot and numeral marking elements squarely face the chart.

Complex structure involving many pivoted mechanical parts and a splined drive shaft is required for effecting such tilting and marking movement of the print wheel. Such parts and their pivots are subject to wear and misalignment which adversely affect the desired tilting operations. This results in poor printing. Specifically, upon such wear and misalignment of the parts, the print wheel no longer is tilted to the required precise angle and as a result, part of a dot only or a part of a numeral only is printed during the printing operations.

These prior art printing mechanisms are further complicated in respect of the use of the splined drive shaft which is used to index the print wheel and to rock the print wheel into printing contact with the chart. This shaft necessarily extends over the distance through which the printing mechanism must be moved in its recording operations, that is, across the width of the chart. As a result the gear reduction unit for driving the splined shaft must be located at an outer end of the shaft, beyond the edge of the chart. The additional required width of the instrument and its casing add both to the size and cost of the instrument.

The prior art print mechanisms thus are subject to disadvantages which limit their usefulness. These disadvantages result from the use of many complex movable parts which are usually driven by a splined shaft, which parts must be adjusted and maintained in alignment for proper operation with each other. Such structures are costly to manufacture. Difficulties arise in the use of such apparatus because of wear, particularly in the adjustment and maintenance in proper operating condition.

Applicant has conceived that the problems of the prior art print mechanisms may be overcome by providing a continuously orbiting rod for achieving all of the required functions of the printing mechanism, indexing the print wheels, and for bringing the print wheels periodically into marking contact with the record chart. Applicant has found that the use of a continuously orbiting rod and a novel arrangement for supporting the dot and identifying numeral print wheels whereby one print wheel may be axially displaced with respect to the other while maintained paralled therewith, permits a substantial simplification and reduction in the number of parts required for printing dots and identifying numerals selectively. Further advantages found to result are reduced friction and wear, reduced size and manufacturing cost of the recording instrument, simplification in the required adjustments of the parts and maintenance, and longer trouble-free operation.

SUMMARY OF THE INVENTION

In accordance with Applicant's invention, there is provided an improved print mechanism for a multipoint recorder having a conventional chart platen and associated chart drive, and structure for supporting the multipoint print mechanism.

The print mechanism includes a rod which extends parallel to the chart platen and is mounted at its ends for movement. The locus of such movement is a cylinder. For convenience, the path of this movement is referred to hereinafter as an orbital path, and the rod is referred to as an orbiting rod. The print mechanism also includes a print carriage which is disposed to move in a path adjacent to and parallel to the chart platen.

The print carriage includes a first or base part which is constrained to move only along a coordinate axis of the chart, that is, linearly, parallel to the platen. The print carriage includes a second part or actuating support plate which is mounted on the said base part for rocking movement toward and away from the platen. A first or dot-print wheel is mounted on a fixed axis on the actuating support plate. A second or number print

wheel is mounted on the said actuating support plate for displacement in a plane parallel to that of the dot print wheel.

A print wheel advance mechanism carried by and responsive to the rocking movement of the actuating support plate relatively to said base part of the carriage is arranged to effect step-by-step rotational advancement of both of said print wheels in unison. Associated with the print wheel advance mechanism is a print wheel selecting means which is operative selectively to position the second or numeral print wheel in either a printing or non-printing relationship with said first or dot print wheel, with respect to the platen.

The rocking movement of the actuating support plate is effected by the continuously orbiting rod. The numeral print wheel is mounted on the actuating support plate of the carriage by means of a pivoted arm that is normally spring biased to a position in which the numeral print wheel is in a non-printing position.

In a preferred embodiment of the invention the print selection means includes a cam rotatable by the print wheel advance mechanism for moving the axis of the numeral print wheel into coincidence with the axis of the dot print wheel and thereby into position for printing with the dot print wheel, at predetermined intervals in the stepwise rotation of said wheels. Another feature of the preferred embodiment is the inclusion in the print selection means of a second cam that is manually adjustable to maintain the numeral print wheel in its position for printing.

More particularly, there has been provided in accordance with the preferred embodiment of the invention, a print mechanism for a multiple-point chart recorder having a continuously orbiting rod, in which rocking motion is transmitted to the actuating support plate of the carriage by way of a pair of spaced apart runners which are carried by the said support plate and between which runners the orbiting rod is arranged to slide. One of the runners is pivotally mounted on the support plate and is spring biased toward the orbiting rod. The actuating support plate carries a stationary shaft about which the dot print wheel and the numeral print wheel can be rotated. This rotation is effected in a step-by-step fashion by a pawl and ratchet and gear drive that is actuated each time the actuating support plate is rocked. The dot print wheel is rocked into and out of contact with the surface of a record chart every time the rocking plate is rocked by the orbiting rod. The numeral print wheel is mounted in a floating manner about the stationary shaft which carries the dot print wheel by means of an arm that is pivotally mounted on the actuating support plate. A cam screw carried by a hub member which is driven in a step-by-step manner by the aforementioned pawl and ratchet gear drive, is arranged to be brought into contact with the aforementioned pivot arm to bias the numeral print wheel to its position for printing in alignment with the dot print wheel. Subsequent rocking action of the support plate by the orbiting rod moves both print wheels as a unit into engagement with the chart to print both a number and dot thereon. As the orbiting rod thereafter continues in its orbital path an additional force is applied by the rod to that one of the runners which is pivoted to the rocking support plate, to cause the print wheels to be pressed more firmly into marking engagement with the record chart.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the present invention may be had when the following detailed description is read in connection with the accompanying drawings in which:

FIG. **1** is a perspective view which is taken from the lower front end of a multiple point strip chart recorder and illustrates the orbiting rod and actuating support plate of the improved print mechanism according to the present invention;

FIG. **2** is a plan view of the strip chart recorder embodying the improved print mechanism of FIG. **1**;

FIG. **3** is an end elevation view taken along the line **3—3** of FIG. **2**;

FIG. **4** is an enlarged elevational view of one end of the print wheel carriage of the improved print mechanism, taken on the line **4—4** of FIG. **2**;

FIG. **5** is a sectional view of the print wheel carriage taken along the line **5—5** of FIG. **4**;

FIG. **6** is an exploded isometric view taken from the upper left front end of the recorder of FIG. **2**, and shows the orbiting rod mechanism of FIG. **1** as having rocked the dot print wheel into printing engagement with the record chart, with the numeral print wheel being retained in a floating, out of contact (or solid line) position, with respect to the chart;

FIG. **7** is a sectional view taken along the lines **7—7** of FIG. **5** in which the dot and numeral print wheels are in axial alignment during a mode of operation of the recorder in which a dot is printed on a chart during each cycle of rotation of the print mechanism and an identifying numeral is intermittently printed on the chart;

FIG. **8** is a sectional view similar to that of FIG. **7** and shows the axis of the numeral print wheel displaced from the axis of the dot print wheel during the same mode of operation of the recorder whereby a dot only is printed on the chart in each cycle of operation of the print mechanism as the orbiting rod rotates;

FIG. **9** shows a modification of the hub and cam screw portion of the mechanism of FIGS. **7** and **8** for providing a modified operation of the print mechanism;

FIG. **10** shows a further modification of the hub and cam screw portions of the mechanisms of FIGS. **7** and **8** for providing a further modification of the operation of the print mechanisms;

FIG. **11** is a sectional view similar to FIGS. **7** and **8** in which the dot and numeral print wheels are retained in axial alignment for the simultaneous printing in every cycle of the print mechanism of a dot and identifying numeral, thereby providing a further mode of operation;

FIG. **12** is a modified form of the mechanism shown in FIGS. **4** and **6**, including an adjustable means for setting the initial angular position of the numeral print wheel with respect to the dot print wheel;

FIG. **13** is a plan view of the modified form of mechanism shown in FIG. **12**;

FIG. **14** shows a typical record that is printed on the record chart during the mode of operation described in connection with the modification of FIGS. **7** and **8**; and

FIG. **15** shows a typical record that is imprinted on the chart during the mode of operation of the print mechanism described in connection with the modification of FIG. **11**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For an understanding of the preferred embodiment of the invention, reference is first made to the perspective view of FIG. 1 which shows the improved print mechanism, designated by the numeral 10, and FIG. 2 which shows the overall construction of a type of multiple point strip chart recorder 12 in which the said print mechanism is embodied.

Orbiting Rod Drive to Effect the Rocking of Print Wheels Into and Out of a Printing Contact with the Chart

The print mechanism 10 shown in FIGS. 1 and 2 includes a drive motor 14 which is supported on a back wall portion of a U-shaped chassis 16 of the recorder 12. In FIG. 2 the drive motor 14 is shown connected by way of a suitable mechanical drive 18 to a Geneva movement 20 which, in turn, is operable to drive a multiple point input selector switch unit 22. The selector switch unit 22 is employed to selectively connect, one after another, of a number of different input variable quantities, such as voltages or currents, each of which represent a different variable under measurement, to the recorder 12 for recording in the manner described, for example in U.S. Pat. No. 3,576,582 to Robert T. Smith or U.S. Pat. No. 2,427,480 to John A. Caldwell. It will be understood, however, that any one of many commercially available recorders may be modified in a manner to incorporate the improved print mechanism of applicant's invention, for effecting the repetitive adjustments of the dot print and numeral wheels of the mechanism to positions along the width of the strip chart which are representative of the magnitudes of each of the variable quantities under measurement as said quantities are connected in succession by said selector switch unit to the recorder. FIGS. 2 and 3 shows a chart 185 on which selected dots and numbers are to be imprinted as extending along a platen 278 between a supply roll 280 and the take up roll 282. FIG. 2 also shows a conventional motor driven gear driving mechanism 284 for moving the chart 185 between a chart supply roll 280 and a chart take-up roll 282.

As is best shown in FIG. 1, the drive motor 14 has an output drive shaft 24 which carries a drive gear 26. Gear 26 is in driving relationship with a gear 28 that is fixed to a drive shaft 30. The drive shaft 30 is shown extending across the width of the chassis 16 and is supported for rotation at its ends on the opposite sides of the U-shaped chassis 16. The drive shaft 30 also carries two additional gears 32, 34 one at each end of the shaft, are both of the same diameter as the gear 28. The gears 32 and 34 are shown in driving relationship with driven gears 36 and 40, respectively. Gear 36 is suitably supported for rotation on a stud shaft 38 which is mounted on one side of the U-shaped chassis 16, and gear 40 is similarly supported on a stud shaft 42 mounted on the other side of the chassis. The stud shafts 38 and 42 are in axial alignment. The gears 36 and 40 are of the same diameter, are in axial alignment, and rotate in unison.

A rod 44, hereinafter referred to as an orbiting rod, is shown in FIG. 1 as extending between the gears 36 and 40. Rod 44 is rigidly attached at its ends to the facing surfaces of the gears 36 and 40, at the same radial distance from the center of each gear. The orbiting rod 44 is of a rigid construction and preferably has a polished surface, and for example, may be made of steel. The rod 44 is arranged to move in unison with the rotation of the gears 36, 40. The locus of the movement of the rod 44 about the centers of the gears 36 and 40 is the surface of a cylinder. One of the positions through which the orbiting rod 44 will pass in its orbital path is shown in solid line form in FIG. 1. Another position through which the rod will pass is shown in FIG. 1 in phantom dot-dash line form.

The orbiting rod 44, as seen in FIGS. 1, 3 and 4, is embraced by a pair of spaced apart members 46 and 48 which, for convenience, are designated runners. The runners 46 and 48 preferably are formed of material which substantially will retain its original shape over long periods of time notwithstanding changes in the environment to which the material is exposed during the operation of the print mechanism and recorder. An acetal resin material such as that known by the Trade Mark as "Delrin" has been found suitable for the runners 46 and 48.

As seen in FIG. 1, runner 46 is in the form of a shoe which extends along the side of and above the upper longitudinal edge of a Z-shaped steel arm 50. The arm or runner support plate 50 is fixably connected at its upper end as by welding to a carriage actuating support plate 52 of a carriage 54.

As is best shown in FIGS. 3, 4 and 5, the carriage actuating support plate 52 is mounted for pivotal movement about a shaft 56 that is staked to a conventional non rotatable angle-shaped base part 58 of the carriage 54.

Runner 46, as seen in FIG. 1, is retained in a fixed position on the plate 50 by means of a screw connection 60 passing through a slot 62 in the runner. The other runner 48 is pivoted on a stud shaft 66 which in turn is fixed for joint rockable movement with the plate 52. The runner 48 is spring biased toward the runner 46. The runners 46 and 48 provide surfaces along which the orbiting rod can slide. FIG. 5 shows the spring biasing means for the runner 48. As there is shown one end 68 of a coil spring 70 extends through an aperture 72 in the carriage actuating support plate 52. The spring 70 is wound about the stud shaft 66 and has its other end 74 inserted, while it is in a wound-up tension condition, through a hole 76 in the runner 48. The spring 70 maintains the surface 64 of the runner 48 in surface-to-surface contact with the orbiting rod 44. By reference to FIGS. 1 and 4, it is seen that the inner surface 94 of a boss 96 of this runner 48 is retained in physical contact with a front edge 98 of a boss 100 formed on the runner 46. This holds the runners 46 and 48 in a separated condition even though the runner 48 is spring biased toward the runner 46. The pawl 88 is held by the coil spring 78 in spring bias surface-to-surface engagement with the tooth 102 of the ratchet wheel 90. As shown in FIGS. 4 and 6 a coil spring 106 and a second pawl 108 are mounted on a stud shaft 104 that is fixed at its inner end to the base plate 58 of the carriage 54.

As seen in FIG. 5, second coil spring 78, also under tension and coiled about the stud shaft 66, has one end 80 retained in a hole 82 in the runner 48. Another end 86 of the coil 78 is shown acting on an outer surface of a pawl 88 to retain the latter in physical contact with the outer surface of the ratchet wheel 90. The pawl 88, as shown in FIG. 6, is mounted for rocking movement about the stud shaft 66 and is held against axial move-

ment along shaft **66** by a cotter **92.** The pawl **108** is held against axial movement along the shaft **104** by means of a cotter **110.**

As is best shown in FIG. **4,** the coil spring **106** has one end portion **112** in engagement with a pin **114** that is fixed to and extends outwardly from the surface of the shaft **104.** The coil spring **106** is tensioned by rotating its other end **116** about the shaft **104** and into spring bias engagement with the outer surface of the second pawl **108,** as shown in FIGS. **4** and **6.** The second pawl **108** is thus shown in engagement with tooth **118** formed on the ratchet wheel **90.** The pawls **88** and **102** cooperate to effect step-by-step clockwise rotation of the ratchet wheel **90** with respect to the actuating support plate **52** each time the latter is rocked in a counter-clockwise direction. This is effective, as hereinafter explained, to operate the print wheel advance mechanism **119.**

Print Wheel Advance Mechanism to Effect the Rocking of Print Wheels Into and Out of Printing Contact With the Chart

The print wheel advance mechanism **119** as seen in FIGS. **5** and **6,** includes a gear train for transmitting the step-by-step arcuate motion of the ratchet wheel **90** to a dot print wheel **120** and also a numeral print wheel **122.** The gear train drive includes: a ratchet driven drive gear **124** having 24 teeth and fixed for rotation with the ratchet wheel **90** about the axis of the shaft **56** and about a sleeve bearing **125** that is fixed to the actuating plate **52,** a gear **126** having a hub member **127** and a cam screw or lobe **128** extending from the hub **127,** said gear **126** being positioned for rotation about the axis of a stud shaft **130** that is fixed to the carriage actuating plate **52,** and an idler gear **132** which is freely rotatable on the stud shaft **134,** on one end of which a numeral wheel supporting arm **136** is pivoted.

A dot print wheel driving gear **138** is provided in driven engagement with the idler gear **132.** The gear **138** is carried on a hub **140** and rotates about a stud shaft **144.** The gear **138** transmits step-by-step rotary motion to the dot print wheel **120** by means of a set screw connection **142.** Thus, the dot print wheel is advanced to a new index position each time that the print wheel advance mechanism **119** is actuated by the ratchet wheel **90.**

FIGS. **1** and **5** also show a numeral print wheel driving gear **146** in driven engagement with the idler gear **132.** The driving gear **146** is provided with the same number of teeth and has the same pitch diameter as the dot print driving gear **138.** The driving gear **146** forms an integral part of the right end of a second hub portion **148** which is fixedly connected for rotary movement by means of a set screw **150** to the numeral print wheel **122.**

A spacer ring shaped member **151** is shown fixedly mounted to the hub portion **148** and prevents axial movement of the pivot mounted arm **136.** The set screw connection **150** between the hub portion **148** and the numeral print wheel **122** allows the step-by-step rotation of the idler gear **132** to also be transmitted to the numeral print wheel **122.** This effects rotation of the numeral print wheel **122** to a new index position in the same manner in which the dot print wheel **120** is indexed. In this manner, the indexing adjustments of the two print wheels are maintained in step with one another.

As seen in FIG. **5,** sleeve bearing **125** is fixed to the actuating plate **52** for rotation about the shaft **56** and is retained against axial movement at one end by means of a washer **152** and a cotter **154** and at the other end by means of a resilient truncated washer **156.** The truncated washer also retains the carriage actuating support plate **52** in spaced apart relationship with the carriage base plate **58.**

A hub **158** having a flange **160** at one end thereof, is provided to support a multi-sector ink pad wheel **162** on the outer end of shaft **56.** Each sector of the ink pad wheel **162** is of a different color. The hub **158** preferably is made of a plastic material, for example, Nylon. The ink pad cover **164** is provided for the ink pad wheel **162.** An opening **166** having a counter sunk wall portion **168** is provided in the cover **164.**

As shown in FIGS. **5** and **6,** the hub **158** is formed with a plurality of prongs **170** which are spread radially from the center of the shaft **56.** The ink pad wheel **162** is attached to the ratchet wheel **90** by a pin **172** which fits into an opening **174** in the side of the ratchet wheel **90.** A resilient plate **176** bears against the prongs **170** to hold the hub **158** and thereby the ink wheel **162** in place on the shaft **56.** The plate **176** is held in place by a cotter **178** at the end of the shaft **144.** A bent portion of the member **176** has a window **180** therein which is aligned with one of the numerals on a tape **182.** The tape **182** is cemented by epoxy to an outer cylindrical surface **184** which is an extension of the dot print wheel **120.** The tape **182** is positioned for rotary movement with the numeral print wheel **122** so that the number viewed by an operator through the window **180** will always correspond to the dot and numeral being printed on the chart **185.**

A circular portion **186** of the dot print wheel **120** is shown in FIGS. **2, 4** and **5** as having one of its many raised spaced apart dot portions **188** in inking contact position with one of twelve different colored pads which are formed on the periphery of the multi-colored ink wheel **162.** The pads of this ink wheel **162** are separated from one another in a conventional manner by means of radial fins **190.** The outer peripheral portion of the numeral print wheel **122** has raised numbers, one to twelve, which are indicated by reference numeral **192.**

The numeral wheel supporting arm **136,** as seen in FIGS. **4** and **6,** has a slideable wedged shaped top plate **194** secured to it by two screws **196** and **198.** The shank of the screw **196** has a jam nut portion **200** which retains the top plate **194** in any selected position on the slot **202.** An elongated slot **204,** as shown in FIG. **2,** is provided in the wedge shaped plate **194.** The shank of screw **198** passes through the slot **204** and enables the aforementioned slideable adjustment to be made when this screw **198** is loosened.

A shaft **206** extends from the rockable support plate **52,** as shown in FIGS. **6–8** and **11,** and is rotatable in a sleeve bearing **208** which is rigidly supported by and extends away from the rockable plate **52.** A cam disc **210** is fixed for rotation with the shaft **206.** FIGS. **7, 8** and **11** show pin **212** fixed to and extending from the cam disc **210.** The pin **212** extends into engagement at an inner end portion with the wall **214** forming one end of a slot in the bearing **208.** An outer end portion of the pin **212** has cylindrical surface extending therefrom which has a groove **218** formed therein with which one end of a tensioned coil spring **220** is in engagement.

The other end of the spring 220 is engaged with the shank of the screw 196 that is fixably mounted for joint movement with the numeral wheel supporting arm 136.

When the cam 210 is in a position shown in FIG. 8, the tension of spring 220 applies a clockwise force to the arm 136, the hub portion 148, the gear 146 and the numeral print wheel 122. This force is effective to rock the indicated parts as a unit about the pivot shaft 134 from the phantom dot-dash line position in FIG. 6 into the solid line position there shown for these parts. In the solid line position, the axis of the numeral print wheel 122 is displaced upwardly from the axis of the dot print wheel 120 while the parallel relationship of both wheels is maintained.

DESCRIPTION OF PARTS TO ACCOMPLISH DIFFERENT MODES OF PRINTING

A first mode — a series of colored dots printed only.

When the cam screw or lobe 128 shown in FIG. 7 is adjusted, that is, screwed in, so that its outer end is flush with the periphery of the hub member 127, and it is not therefore effective as a lobe, the dot print wheel 120 will be retained in a position to successively and repetitively print dots on the chart 185. A dot will be printed on the chart 185 each time the orbiting rod 44 moves the carriage actuating support plate 52 and the print wheel advance mechanism 119 mounted thereon from the phantom dot-dash line position to the solid line position shown in FIG. 6. Each dot will carry the color of the sector of the ink pad wheel 162 which is engaged by the dot portion 188 of the dot print wheel 120 just prior to the printing impact on the chart.

A second mode — a series of colored dots and an identifying number printed at predetermined intervals with the setting of set screw cam or lobe 128 and cams 210 as illustrated in FIGS. 7 and 8.

Cam screw or lobe 128, as shown in FIG. 7, extends from the hub portion 127 of the gear 126. Gear 126 has 26 teeth. Since this gear 126 is driven by a gear 124 which has 24 teeth, the gear 126 makes less than a full revolution, specifically twelve-thirteenths of a revolution, for each full revolution of the dot and numeral print wheels 120, 122. In the embodiment of the invention shown, the gear 126 and the cam screw 128 are rotated in a counter clockwise direction, the latter into engagement with a roller 222 once in each revolution. Roller 222 is mounted on a shaft 224 on the upper portion of the supporting arm 136. Engagement of cam screw 128 with roller 222 effects a counter clockwise rocking movement, as a unit, of the supporting arm 136, hub portion 148 and the numeral print wheel 122. This causes the numeral print wheel to be moved into marking engagement with the chart 185. Such numeral printing operation occurs intermittently, that is, each time that the cam screw 128 in its orbiting motion engages the roller 222. A different identifying numeral is printed during each of said printing operations, that is, after each of the 12 different colored ink dot portions 188 of the dot print wheel 120 have been printed one after another on the chart 185. That is to say, a different input quantity or variable identifying numeral is printed on the chart adjacent to every thirteenth dot, to produce a record as illustrated in FIG. 14. Such sequential printing of identifying numbers from 1 to 12 is effected because gear 126 which carries the cam screw 128 makes twelve-thirteenths of a revolution for each full revolution of the print pad wheel 164 and dot and numeral print wheels 120, 122. The numeral printing cycle will repeat when all 12 numerals have been printed. Such repetition occurs every one hundred and fifty-sixth rotation of the hub member 127.

FIGS. 9 and 10 show two other modified forms of the second mode of printing that are useful when more frequent printing of identifying numerals is desired. Such more frequent printing may be accomplished by employing a pair of lobes in the form of cam screws 225, 226, as shown in FIG. 9, or employing three cam screws 228, 230, 232, as shown in FIG. 10. When two cam screws 225, 226 are employed as shown in FIG. 9, printing on the chart of two different identifying numerals will take place each time that the hub member 127 is moved in a step by step fashion through each 360° of rotation and dots individually representative of the magnitudes of each of the twelve input quantities under measurement have been recorded. The numeral printing cycle will repeat when all twelve numerals have been printed. Such repetition occurs after eighty-four (84) rotations of the hub member 127. When three cam screws 228, 230, 232 are employed, as shown in FIG. 10, sequential printing on the chart of three different identifying numerals will occur during each 360° of rotation of the hub member 127. Again, the numeral printing cycle will repeat when all 12 numerals have been printed. Such repetition occurs after 60 rotations of the hub member 127.

The adjustment of cam 210 to the position shown in FIG. 11 shows a third mode of printing that provides the continuous printing of a series of different colored dots and an identifying numeral of the same color as the dot along side each dot. A lever 234 carried by cam 210 facilitates such adjustment. In the FIG. 11 position the cam 210 is engaged with the plate 194 and is effective to apply a counter clockwise rocking force against the supporting arm 136 in opposition to the clockwise biasing force of the spring 220.

This causes the supporting arm 136, hub 148, and numeral print wheel 122 to be rocked counter clockwise to a position in which the axis of the numeral print wheel 122 is aligned with the axis of the dot print wheel 120. With the axis of the dot and numeral print wheels thus maintained in alignment, both print wheels will be actuated into engagement with the record chart once during each cycle of the orbiting rod and printing mechanism. As a consequence, a record identifying numeral will be printed along side each dot to produce a record as illustrated in FIG. 15.

When the cam 210 is in the FIG. 11 position, the set screw cam 128 will pass the roller 222 without transmitting any movement to the supporting arm 136.

An alternative mechanism for adjusting the position of the numeral print wheel 122 between a printing and a non-printing position is shown in FIGS. 12 and 13. This mechanism includes a slotted sleeve bearing 236 and a shaft 240. The bearing 236 is fixed at 238 to the rockable carriage actuating support plate 52. Ths shaft 240 extends through and is rotatable in the sleeve bearing 236 and has one end extending beyond the plate 52. Longitudinal movement of the shaft 240 is restrained in any suitable manner, as by a cotter 242. A cam 244 is provided at the inner end of the shaft 240. This cam may have substantially the same cam profile as the pre-

viously described cam **210** of FIGS. **7, 8** and **11,** and is similarly moveable between two positions.

The arcuate ends **246** and **248** of the slot in bearing **236** form stops for a pin **250.** An inner splined end **252** of pin **250** extends through and is in press fit relationship in an opening **254** of the cam **244.** The outer end of the pin **250** is provided with an annular groove **256** to which one end of the spring **220** is connected. As seen in FIG. **12,** the other end of the spring **220** passes through a hole **258** in a pin **260.** Pin **260** is fixed by a screw thread connection at **262** with supporting arm **264** which is analogous to the supporting arm **136** illustrated in FIGS. **6–8** and **11.**

Adjustment of this alternative printing mechanism for numeral printing or non-printing is effected by manual adjustment of a handle **266** which is attached to the cam **244.** In the position shown in FIG. **12,** the supporting arm **264** is in its counterclockwise position and the axis of the numeral print wheel is displaced from the axis of the dot print wheel. Specifically, the spring **220** holds the stop **246** and the cam **244** out of contact with the head of an adjustable lock screw **268** which is carried by arm **264.** The numeral print wheel is then in its non-recording position. Clockwise rocking of the handle **266** from the position shown in FIG. **12** moves the axis of the numeral print wheel into alignment with the axis of the dot print wheel, and as a result, into recording position.

NUMERAL PRINT WHEEL ADJUSTMENT

In the apparatus embodiment of FIG. **12** and **13,** means comprising set screws **270** and **272** are provided for adjusting the initial angular position of the numeral print wheel **122** for bringing the numerals and dots, as recorded on the chart, in close side by side relationship. Loosening of one or the other of the screws and tightening of the remaining one effects an angular adjustment of the numeral print wheel in one direction and vice versa.

MULTI POINT BALANCEABLE POTENTIOMETRIC MEASURING SYSTEM

In the operation of the present invention as previously noted, the carriage **54** of the improved printing mechanism is brought to successively different printing locations above the chart **185** as the associated self-balancing potentiometer mechanism is balanced for each of the input quantities under measurement. At the same time, the printing mechanism is actuated to ratchet both print wheels **120** and **122** to their next printing location above the chart **185** in timed relation to the rocking of the actuating plate **52** by the continued orbiting of rod **44.** To this end the recorder apparatus illustrated in the drawings includes a conventional potentiometric servo balancing mechanism (not shown) having a balancing motor (also not shown) which moves the carriage **54,** as by means of a cable or wire **292** and clamping means **294** and **296,** as seen in FIG. **3,** across and above the chart **185** to each of the successive printing positions as the potentiometer mechanism is repetitively balanced for each of the input quantities under measurement.

The structure for supporting the carriage **54** in its back and forth movement across the chart **185** includes a pair of shafts **298** and **302** both of which extend between and are rigidly supported by the sides of the U-shaped chassis **16** of the recorder **12.** Specifically, shaft **298** extends through an opening in the base part **58** of the carriage **54.** A bearing **300** which is carried by an extension of base part **58** slides along the shaft **302.** The carriage **54** is thus constrained by the shafts **298** and **302** for movement along the coordinate axis of the chart that is parallel to the platen **278** and the chart driving sprocket roller **304.**

For the purpose of preventing movement of the carriage **54** along the chart during the period of time that a printing operation is taking place and one or both of the print wheels are in marking engagement with the chart, a switch **288** which is connected by the electrical leads **286** in the circuit to the self-balancing electrical motor, is provided for momentarily deenergizing the motor during such marking period or interval. Thus, as shown, in FIG. **3,** the switch **288** is arranged to be so actuated by the orbiting rod **44** to disconnect the electrical power to the balancing motor an instant before one or both of the print wheels **120** and **122** are brought into marking engagement with the chart **185,** and for reestablishing that power connection immediately after the print wheels have been lifted off the chart.

MODE OF OPERATION

A. Orbiting Rod Drive

By reference to FIG. **1** it is seen that the rotation of the shaft **24** of the drive motor **14** is transmitted by way of two similar gear trains **26, 28, 32, 36** and **26, 28, 34, 40** to rod **44** which extends between the gears **36** and **40.** The rod **44** is thus made to orbit in a path in the direction of the arrow about the center of the shafts **38, 42** which support the gears **36** and **40.**

As the motion of the rod **44** in its orbital path takes place, the rod alternately slides in a downward direction along the adjacent surface of runner **46** and then moves away from contact with the runner **46** and slides in an upward direction along the adjacent surface **64** of the runner **48.** In the position shown in FIGS. **1, 3, 4** and **6** the rod is in engagement with the runner **48** only and is effective to apply a force to the runner **48** to move the latter and the carriage actuating supporting plate in a clockwise direction, as seen in FIGS. **1** and **4.** When in engagement with the runner **46,** the rod **44** moves the latter and the carriage supporting plate in a counterclockwise direction.

Specifically, during the portion of the cycle that the orbiting rod **44** is effective to apply a force to the surface **64** of runner **48,** the Z-shaped steel arm **50,** to which the runner **46** is attached, and the rotatable carriage actuating plate **52** to which the arm **50** is attached, will be moved in unison in a clockwise direction about the axis of shaft **56** and sleeve bearing **125** to a printing position. During the initial clockwise orbiting motion of the rod **44** as viewed in FIG. **1,** the carriage actuating plate **52** will be moved in a counterclockwise direction from its solid line printing position to its non-printing position shown in dot-dash lines.

By reference to FIGS. **1** and **3,** it is seen that as the orbiting rod **44** completes a full revolution, or 360° orbit, the carriage actuating plate **52** will be moved from its phantom dot-dash line or non-printing position, back to the printing position shown in solid lines. The orbiting rod **44** will thus cause the carriage actuating plate **52** to be continuously rocked into and out of a printing position.

PRINT WHEEL ADVANCE MECHANISM

Referring to FIG. 6 it can be seen that upon movement of the carriage actuating support plate 52 in a counterclockwise direction, the advance pawl 108 will engage a tooth, for example, tooth 118 on the ratchet wheel 90 and thereby cause the latter to be advanced one step in a clockwise direction relative to the carriage actuating plate 52. During such counterclockwise movement of the support plate 52, the stop pawl 88 slides in a counterclockwise direction out of engagement with a tooth on the ratchet wheel 90 over the outer surface of and into non-driving contact with an adjacent tooth of the ratchet 90. As the carriage actuating plate 52 is thereafter moved in the clockwise direction from its phantom position shown in FIG. 6, the stop pawl 88 is brought into clockwise contact with the aforementioned adjacent tooth with which it now becomes engaged, whereupon the ratchet wheel 90 and support plate 52 move jointly in a clockwise direction relative to the carriage base plate 58 without advancing the print wheel advance mechanism 119. This clockwise movement of the ratchet wheel 90 occurs while the advance pawl slides over a tooth on the then moving ratchet wheel 90 and into a position for engaging the next adjacent tooth of this ratchet wheel 90.

Such step-by-step advancement of the ratchet wheel 90 is transmitted to the multi-colored ink pad wheel 164 by means of a pin and slot connection 174, 172, as is best seen in FIG. 5.

When the advance pawl 108 is engaged in a tooth on the ratchet wheel 90 so that the latter is held in a fixed relation to the carriage base plate 58, clockwise movement of the stop pawl 88 causes the actuating support plate 52 to rotate through approximately 35°. The gear 124 has 24 teeth and is connected for joint step-by-step rotary movement with the ratchet wheel 90. The center of the 26 tooth gear 126 is arranged to orbit through an arc about the center of a gear 124 as the aforementioned step-by-step movement of the ratchet wheel 90 takes place. Movement of the gear 126 in this manner causes the remaining gears of the print wheel advance mechanism 119 to also be advanced in a step-by-step manner, as hereinafter described. The 26 tooth gear 126 and the gear 132, which has 20 teeth, are both idler stages. The 24 tooth ink pad gear 124 and the two 24 tooth gears 138 and 146 are identical, but gear 124 rotates in one direction and the gears 138 and 146 rotate in the opposite direction.

As is best shown in FIG. 5, the numeral print wheel 122 is constrained by screw 150 to rotate with the hub 148 and the gear 146 and the dot print wheel 120 is constrained by screw 142 to rotate with the hub portion 140 and the gear 138. The ink wheel 162 is pinned at 172 in radial constraint and for step-by-step movement with the ratchet 90. The diameters of the print wheels 120 and 122 are such that their respective peripheral surfaces 188 and 192 engage the ink wheel 162 in step-by-step rolling contact.

FIRST MODE OF PRINTING

A series of different colored dots will be continuously printed on the chart 185 when the cam 210 is placed in the position as shown in FIG. 8 and when the cam screw 128 is adjusted so that its outer end is flush with the outer surface or periphery of the hub member 127. When the cam screw 128 is adjusted to this latter position, the arm 136 will be rocked clockwise about the axis of the stud shaft 134 by means of biasing spring 220 whereby the center of the numeral print wheel 122 will be slightly displaced off the center of the dot print wheel 120 and thereby out of printing alignment with the axis of the dot print wheel. This will enable only a continuous series of dots to be printed on the chart 185 by the dot wheel 188 each time the actuating plate 52 is rocked by the orbiting rod 44 into a printing position.

SECOND MODE OF PRINTING

The cam screw 128 on the gear hub 127, as viewed in FIG. 6, projects radially outward from the hub and engages the roller 222, which is carried by the supporting arm 136, once in each revolution of the hub 127. In this manner the arm 136 is rocked clockwise, as seen in FIG. 6, about the stud shaft 134 from the solid line position to its phantom line position. The axis of numeral print wheel 122 as shown in phantom line form, will then be in alignment with the axis of the dot print wheel 120. The gearing between the numeral print wheel 122 and the hub 127 is such that the axis of the numeral print wheel 122 is brought into alignment with the dot print wheel 120 by the cam set screw 128 at every thirteenth dot indexing cycle. When the axes of the two print wheels 120, 122 and shaft 144 are in alignment, the numeral print wheel 122 will print a numeral beside a dot on the chart 185. The numeral and dot will be both of the same color as picked up from the ink wheel 162. When the axis of the numeral print wheel 122 is spring biased by the spring 220 to an off center position from the axis of the dot print wheel 120, and the cam set screw 128 is out of contact with the roller 222, as shown in FIG. 8, only dots will be printed on the chart 185. Thus identifying numerals are printed intermittently only, once in each cycle of rotation of hub 127. As a consequence a numeral is printed with every thirteenth dot.

MODIFIED NUMBER TWO MODE OF PRINTING

By varying the number of cam lobes, such as by using the two lobe set screw cam arrangement 225, 226 of FIG. 9, and the three lobe set screw cam arrangement 228, 230 and 232 of FIG. 10, and by changing the gear ratio between the hub 127 of gear 126 and the numeral print wheel 122, the frequency of the identifying numeral printing to the number of dots printed on the chart 185 as well as their printing sequence, can thus be varied.

THIRD MODE OF PRINTING

When the cam 210 is adjusted to the position shown in FIG. 11, the axis of the numeral print wheel 122 is retained in axial alignment with the axis of the dot print wheel 120. In accordance with this mode of printing, the cam screw 128 will remain out of contact with the roller 222 as the hub 127 is rotated. In this mode of printing, therefore, an identifying number will be printed along side each dot to provide a record as illustrated in the chart of FIG. 15.

PRINT WHEEL INKING AND PRINTING

As shown in FIG. 6, the multi-ink pad wheel 162 is connected to the ratchet wheel 90 for joint step-by-step rotary movement in a clockwise direction about the axis of shaft 56 as the orbiting rod 44 is continuously

rotated. The rotary step-by-step motion of the ratchet wheel **90** is also employed to drive the print wheel advance mechanism **119.** The latter, in turn, drives the dot and numeral print wheels **120, 122** in a step-by-step counterclockwise direction about the axis of shaft **144.**

After the print wheels have been brought into engagement with the ink pads of ink wheel **162,** a 90° step-by-step rotation only of the print wheels **120** and **122** is required for the printing or marking engagement of one or both print wheels with the chart **185.** As a result the ink picked up by the dots and numerals of the print wheels is not allowed to dry out and is still in good moist printing condition when the dots and numerals are moved into printing contact with the chart **185.** This avoids the ink drying out problem which has been encountered with other prior art constructions in which the print wheels are required to rotate 270° between the time that their dot and numerals are inked by an ink pad and the time that these dot and numerals are brought into marking engagement with the record chart.

PRINT WHEEL IMPRESSING MECHANISM

In the recording operation of the printing mechanism the dots and numerals of the print wheels are first brought into printing or marking engagement with the chart **185.** Substantially simultaneously with this action the dots and numerals are then firmly pressed into engagement with the chart in a controlled manner to produce clear printing but without perforation of the chart. The energy required to effect such controlled and printing firm engagement with the chart is derived from springs **70** and **78** which are wound up about shaft **66.** Shaft **66** supports runner **48** and as the orbiting rod **44** actuates the latter upwardly, as seen in FIG. **3,** to move the print wheels into marking engagement with the chart, the energy thus stored in the springs **70** and **78** is transmitted through the actuating plate **52** and its stationary shaft **144** to limit the amount of force that can be applied by the orbiting rod **44** through the runner **48** to the print wheels for pressing the latter into marking engagement with the chart. By proper selection of the springs **70** and **78,** a dot, or a dot and a number may be firmly and clearly printed on the chart with no tendency for chart perforation.

The values of the quantities recorded by the print wheels **120, 122** can be determined by visual inspection of and reference to the scale line on the chart **185.**

Alternatively, the value of the quantity under measurement may be observed by means of a conventional index **306** which, as shown in FIG. **3,** is attached to the base portion **58** of the carriage **54** and which moves with the carriage along a calibrated scale **308.**

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A printing apparatus for recording a varying characteristic of a multiplicity of variables in a selective manner on a chart, comprising, a base member, means to constrain said base member for linear movement, a support member pivotally mounted on said base member for movement between two positions, a print wheel having printing markers angularly spaced about its periphery and rotatably mounted on said support member, said print wheel being in position for printing by one of said markers when said support member is in one only of said positions, a rod, means to drive said rod in an orbiting path the locus of which is a cylinder, the axis of which cylinder extends in the direction of movement of said base member, a pair of runners carried by one end of said support member and positioned on opposite sides of said rod, said orbiting rod and said runners forming a driving connection whereby said support member is angularly rocked to and fro about said base member between said two positions as said rod is driven in its orbiting path, thereby to move a marker of said print wheel into and out of its printing position.

2. The printing mechanism defined in claim **1** wherein a driving connection is employed between said print wheel and said base member whereby said print wheel is rotated to sequentially advance an adjacent marker of said print wheel into printing position each time said print wheel is moved out of its printing position.

3. A printing apparatus for recording a varying characteristic of a multiplicity of variables in a selective manner on a chart, comprising a chassis, a print carriage having a part mounted on said chassis for back and forth non-rotatable movement in response to changes occurring in the magnitude of said varying characteristic as each one of the selected number of variables are recorded, a support member pivotally mounted on said carriage, a first print wheel having a number of identical spaced apart marks thereon and rotatably supported for rotation on said support member, a second separate print wheel having a number of different indicia thereon and mounted for pivotal movement on said support member, a driving means, a rod connected to the driving means for movement along an orbital path, said rod being operably connected to move the support means in an oscillating manner on the carriage, means to selectively move said second print wheel so that its axis is brought into and out of alignment with an axis about which said first print wheel is rotated and thereby effect movement of both of said wheels into printing engagement with said chart during said oscillation of said support member when said axis are aligned with one another and to effect movement of only the first mentioned print wheel into said printing engagement when said axis are out of alignment with one another.

4. The printing apparatus as defined in claim **3** wherein said support member has a pair of spaced apart runner plates and wherein said rod is positioned to continuously ride along one runner plate in one direction and thereafter along the other runner plate in the opposite direction to apply said oscillating movement to said support member and said first and second print wheels mounted thereon.

5. The printing apparatus as defined in claim **3** wherein said support member has a pair of spaced apart runner plates and wherein said rod is positioned to continuously ride along one runner plate in one direction and thereafter along the other runner plate in the opposite direction to apply said oscillating movement to said support member and said first and second print wheels mounted thereon, and wherein one of said runner plates is fixedly connected for movement with said support member and another one of said runner plates has a spring biasing means connecting it to said support member for transmitting thereto the movement it receives from said rod as it travels through its orbit, said

rotation of the orbiting rod being further operable to transmit an additional force through said spring biasing means to said support member and the print wheels to more forcefully impress said wheels into contact with said chart after said print wheels are brought into said first mentioned contact with the chart.

6. The printing apparatus as defined in claim 3 wherein the first print wheel is mounted for rotation about a shaft that is in turn fixedly mounted on the support member for oscillatory movement therewith, the second print wheel has a hub portion extending therefrom and which is in spaced apart relationship about said shaft, a second shaft extending from said support member, said means to selectively move said second print wheel is comprised of a movable arm that is pivotally mounted at one end for rotation about said second shaft and which has a second end forming a sleeve bearing about the outer surface of said hub and wherein a wedge is formed in an outer portion of said arm, a rotatable cam retained in spring biased engagement with said arm by a spring which when rotated in one direction is employed to contact and move said wedge and hub portion connected therewith in one direction to effect movement of said second print wheel so that its axis is brought into alignment with an axis about which said first print wheel is rotated and when rotated in an opposite direction effects movement of the cam to a position that is out of contact with said wedge surface and in which said second print wheel is retained out of alignment with said axis of said first print wheel.

7. The printing apparatus as defined in claim 3 wherein the first print wheel is mounted for rotation about a shaft that is in turn fixedly mounted on the support member for oscillatory movement therewith, the second print wheel has a hub portion extending therefrom and which is in spaced apart relationship about said shaft, a second shaft extending from said support member, said means to selectively move said second print wheel is comprised of a movable arm that is pivotally mounted at one end for rotation about said second shaft and which has a second end forming a sleeve bearing about the outer surface of said hub and an adjustable portion extending from an outer surface of said arm, a spring biased rotatable cam mounted for rotation on said support member which when moved in one direction is operable to be engaged with the end of said arm portion to jointly move said arm portion, hub and second print wheel so that the axis of the second print wheel will be brought into alignment with the axis of said first print wheel and when moved in an opposite direction will cause said cam to be disengaged from said arm portion and the axis of said second print wheel to be moved out of alignment with the axis of said first print wheel.

8. The printing apparatus as defined in claim 3 wherein a shaft is fixedly connected to the said support member, the inner surface of a sleeve bearing is mounted for rotation about said shaft, the support member is fixed for said oscillatory movement to the outer surface of the sleeve bearing, a first gear is mounted for rotation on said sleeve, a first idler gear is in driven contact with said first gear, a second idler gear in contact with said first idler gear and with separate gears of the same diameter that are respectively connected to separately drive said first and second print wheels, a ratchet wheel mounted in fixed relation to one end of the first gear, a pawl driving mechanism in contact with said ratchet wheel and with said support member to rotate said ratchet wheel, the gears and print wheels driven thereby in a step-by-step manner as the support member is rotated in an oscillatory manner by the orbiting rod.

9. The printing apparatus as defined in claim 3 wherein a shaft is fixedly connected to the said support member, the inner surface of a sleeve bearing is mounted for rotation about said shaft, the support member is fixed for said oscillatory movement to the outer surface of the sleeve bearing, a first gear is mounted for rotation on said sleeve, a first idler gear is in driven contact with said first gear, a second idler gear in contact with said first idler gear and with separate gears of the same diameter that are respectively connected to separately drive said first and second print wheels, a ratchet wheel mounted in fixed relation to one end of the first gear, a pawl driving mechanism in contact with said ratchet wheel and with said support member to rotate said ratchet wheel, the gears and print wheels driven thereby in a step by step manner as the support member is rotated in an oscillatory manner by the orbiting rod, and wherein a cam lobe is connected to an protrudes away from an outer hub surface of said first idler gear, a means for rotatably supporting said second print wheel on the support member, a roller pivotally mounted for rotation on an outer surface of said second print wheel supporting means, and said lobe being operable in a step-by-step fashion over every 360° of its radial rotation to engage said roller and to move said second print wheel support member and the second print wheel from a non-printing position to a position in which its axis is aligned with the axis of the first print wheel.

10. The printing apparatus as defined in claim 3 wherein the second print wheel is rotatably supported by an arm that is pivotally mounted on the support member, a roller is mounted on said arm, a hub is operably connected to the support member to move in a step-by-step rotary fashion therewith during each oscillation of the support member, the outer surface of said hub having at least one lobe protruding therefrom for moving said roller, the arm and the second print wheel to a position in which the central axis of said second wheel is in alignment with the central axis of said first wheel.

11. The printing apparatus as defined in claim 3 wherein each of the marks on the first print wheel and each of the indicia are positioned for rotatable engagement with a different colored ink pad of a print wheel inking pad that is mounted for rotation on said carriage each time said support member is oscillated and ninety degrees prior to the time each one of said wheels are brought into printing engagement with the chart.

12. The printing apparatus as defined in claim 10 wherein the first mentioned means that is operable to move said second print wheel supporting arm and the roller attached thereto into said position in which said axis of the second print wheel is aligned with the axis of said first print wheel is further operable by means of a cam that is pivotally mounted on said support member which is retained in spring biased engagement with said arm by means of a spring to simultaneously move the roller to a position away from and out of contact with said lobe that extends from said hub.

13. A printing apparatus for recording a varying characteristic of a multiplicity of variables in a selective manner on a chart, comprising, a base member, means to constrain said base member for linear movement, a support member pivotally mounted on said base member for movement between two positions, a first print wheel having printing markers angularly spaced about its periphery and rotatably mounted on said support member, said first print wheel being in position for printing by one of said markers when said support member is in one only of said positions, an orbiting rod, said support member having a slot formed therein, said orbiting rod being disposed within the slot of said support member whereby the latter is rocked to and fro about said base member between said two positions as said rod is moved through said orbiting path and to thereby move one of the markers of said first print wheel into and out of its printing position, a second print wheel having angularly displaced markers thereon, an arm pivotally connected at one end to said support member and supporting the said second print wheel on its other end, a spring biasing means connected at one end to said support member and to the said arm at its other end to hold the said second print wheel out of axial alignment with said first print wheel, a gear train mounted on the said support member to transmit step-by-step angular movement to said print wheels as said support member is rocked between its said two positions, a hub forming a rotatable portion of said gear train, a lobe on the periphery of said hub arranged for engagement with said arm to periodically move said arm in a direction against the bias of said spring means and thereby move said second print wheel into axial alignment with said first print wheel whereby a printing marker on said first print wheel and an associated identifying marker on said second print wheel will simultaneously be moved into and out of said printing position as the said support member is moved to and from about said base member between its said two positions.

14. A printing mechanism defined in claim 13 wherein said slot formed in said support member is formed from a pair of spaced apart runner plates and the said orbiting rod is adapted to be connected in driving contact with said runner plates to effect the said rocking motion of said support member about the said base member between its said two positions.

15. A printing mechanism as defined in claim 13 wherein said slot formed in said support member is formed from a pair of spaced apart runner plates and wherein said orbiting rod is positioned to ride along one runner plate in one direction and thereafter along the other runner plate in an opposite direction to effect rocking of said support member between its said two positions.

16. A printing mechanism defined in claim 13 wherein the first print wheel is mounted for rotation about a shaft which is mounted on the support member, and wherein said shaft extends through an opening in said second print wheel, which opening in at least one dimension is larger than the diameter of said shaft to permit movement of said second print wheel into and out of axial alignment with said first print wheel.

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