Dec. 8, 1959 E. O. WITT ET AL 2,915,968

PRINTER

Filed Oct. 30, 1958 4 Sheets-Sheet 1

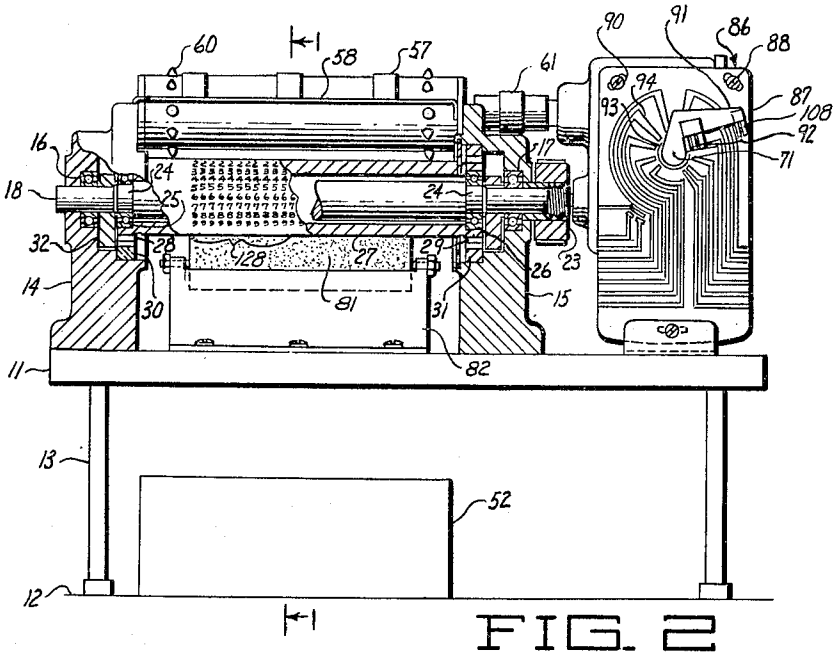

FIG. 2

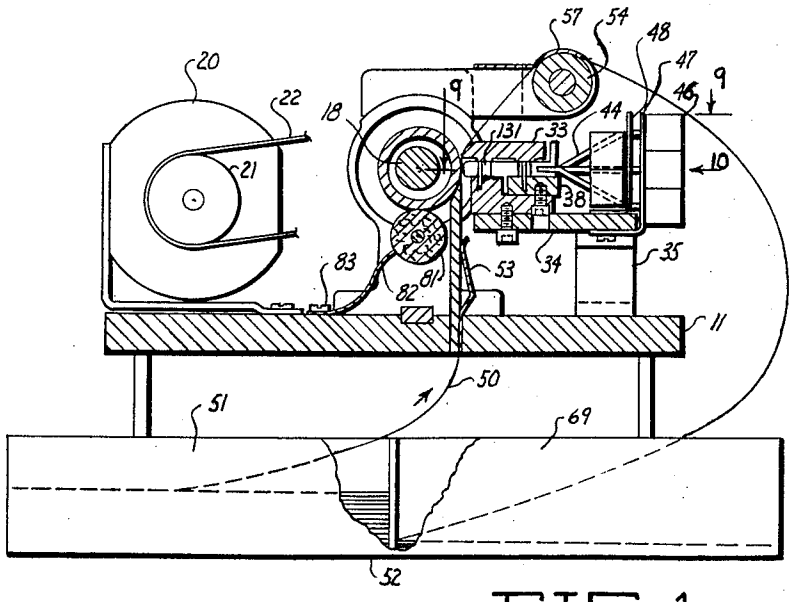

FIG. 1

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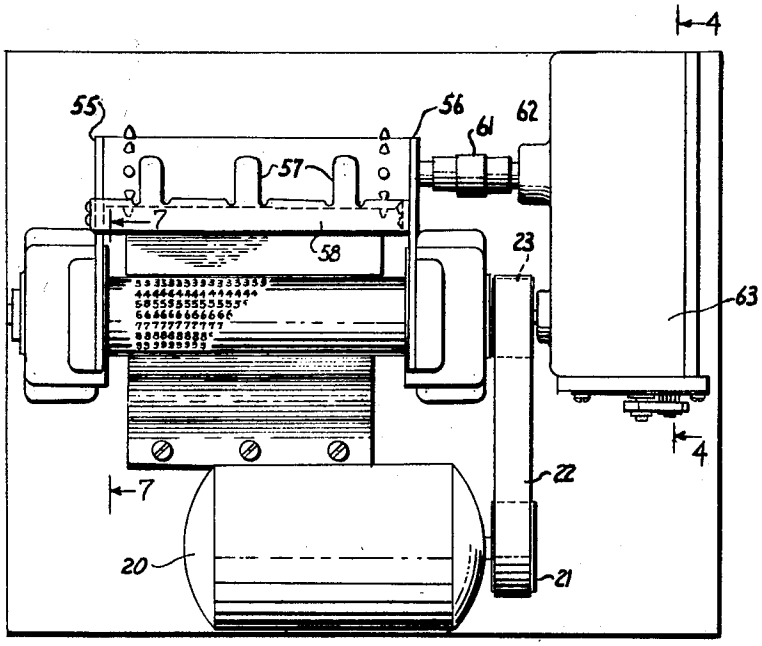

FIG. 3

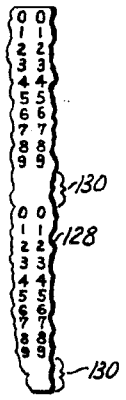

FIG. 5

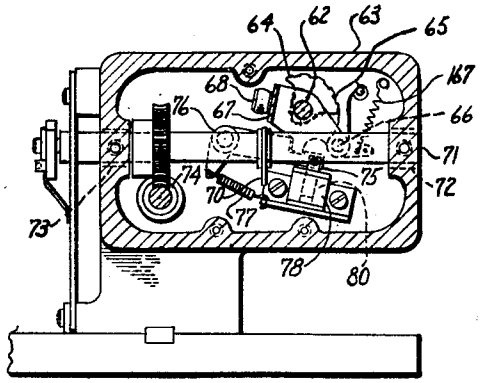

FIG. 4

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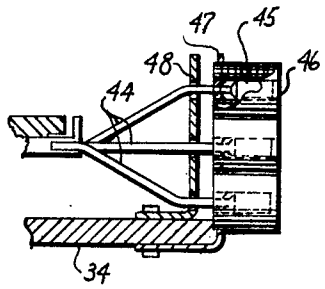

FIG. 8

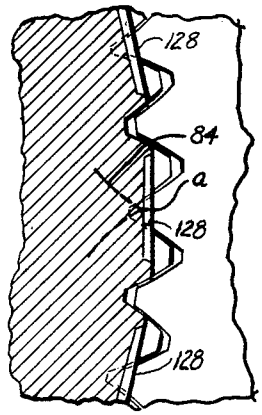

FIG. 6

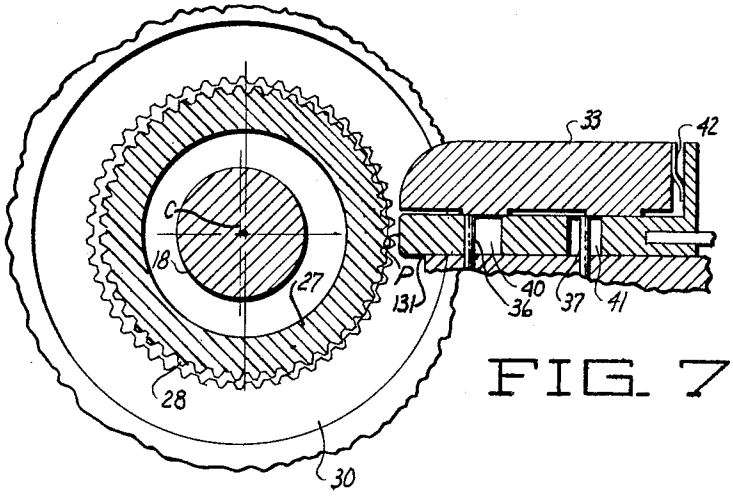

FIG. 7

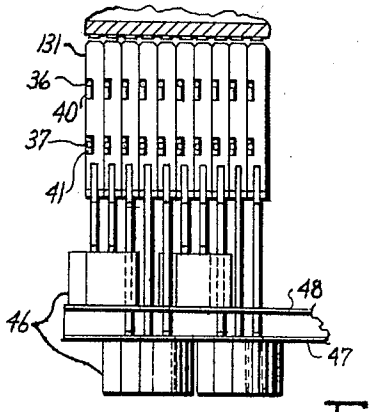

FIG. 9

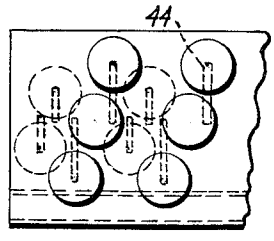

FIG. 10

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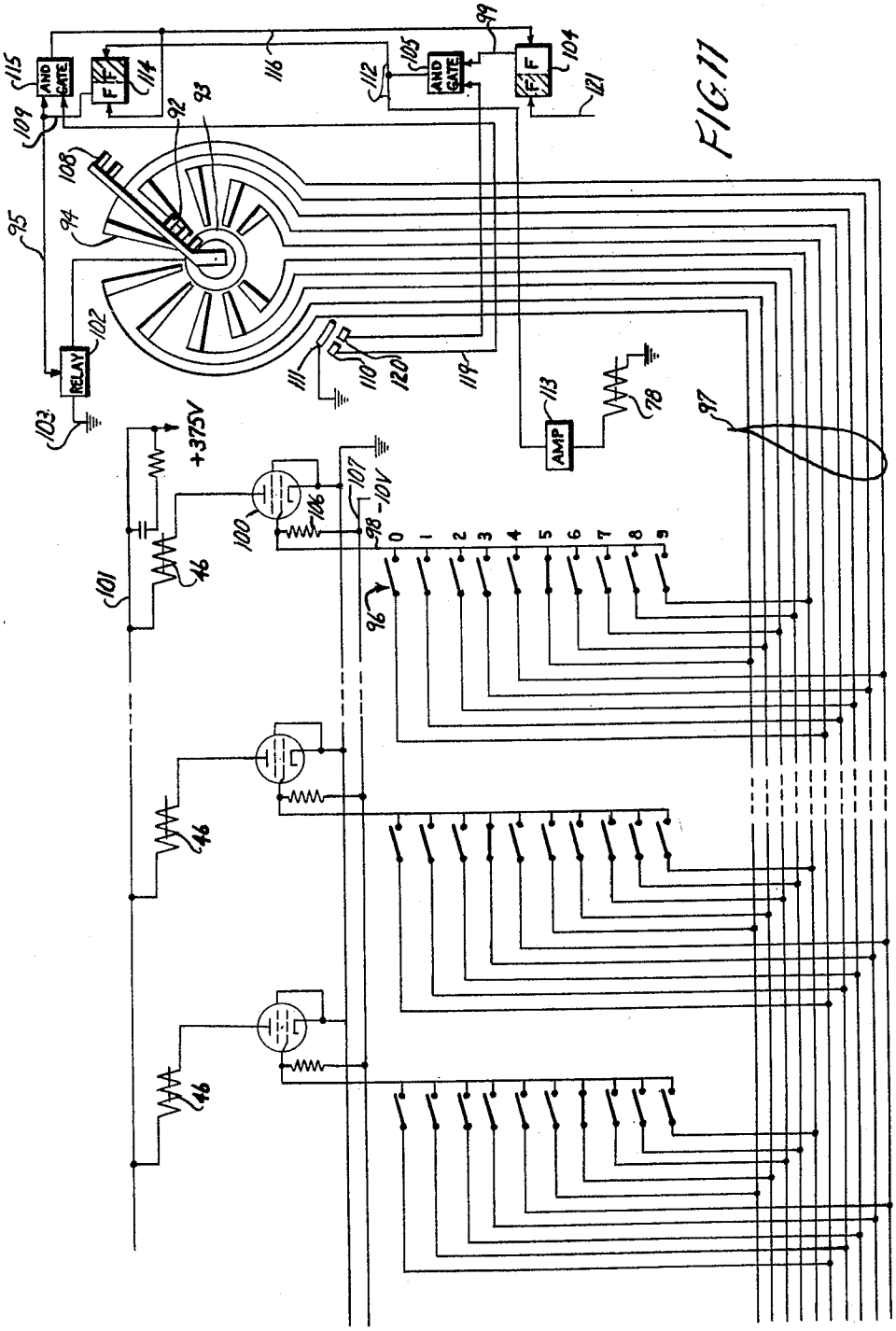

FIG. 11

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Patented Dec. 8, 1959

2,915,968

PRINTER

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Application October 30, 1958, Serial No. 770,719

12 Claims. (Cl. 101—93)

This invention relates to printers for line printing selective characters and has particular reference to a high speed printer of this type.

A generally successful form of high speed printer now in use comprises a constantly rotating drum having different type characters spaced therearound so as to serially present the various type characters to a printing station. A hammer or platen in line with each row of type characters is timed to strike an interposed record medium against a selected type character as the latter passes the printing point.

Obviously, the timing of the hammers must be extremely accurate and the impact must be substantially instantaneous to prevent blurring or smudging of the impression due to the continuous movement of the type characters past the printing point. Also, any minute differences in timing of the hammers will result in an uneven line of typing, with different type characters being printed above or below the remaining line of type.

The problem of maintaining proper critical timing of the printing impact increases with increased speed of rotation of the type drum and this, in addition to the smudging tendency, becomes a limiting factor as higher printing speeds are attempted.

It therefore becomes a principal object of the present invention to overcome the difficulties encountered in high speed printers of the above type.

Another object is to provide a relatively simple and yet reliable high speed printer.

Another object is to provide a high speed printer comprising a constantly operated type drum which presents each type character to the printing point for a finite period of time.

Another object is to provide a high speed printer comprising a continuously operated type drum which effects a printing impression against a platen held stationary during the printing impression.

Another object is to provide a high speed printer of the continuously rotating drum type which requires relatively simple printing impression control means.

The manner in which the above and other objects of the invention are accomplished will be readily understood on reference to the following specification when read in conjunction with the accompanying drawings, wherein:

Fig. 1 is a sectional side view taken substantially along the line 1—1 of Fig. 2 illustrating a printer embodying a preferred form of the present invention.

Fig. 2 is a front view, partly in section, of the printer.

Fig. 3 is a plan view of the printer.

Fig. 4 is a transverse sectional view through the paper feed transmission unit and is taken substantially along the line 4—4 of Fig. 3.

Fig. 5 is a developed view of one of the rows of type characters formed on the drum.

Fig. 6 is an enlarged fragmentary sectional view illustrating the relationship between the internal and external gears and the type characters formed on the drum.

Fig. 7 is an enlarged sectional view through the printing drum and is taken substantially along the line 7—7 of Fig. 3.

Fig. 8 is an enlarged sectional view illustrating certain of the platen positioning solenoids.

Fig. 9 is a fragmentary sectional plan view taken substantially along the line 9—9 of Fig. 1 illustrating the various printing platens and their actuating solenoids.

Fig. 10 is a fragmentary sectional view illustrating the nesting arrangement of the printing platen solenoids and is taken in the direction of the arrow 10 in Fig. 1.

Fig. 11 is a schematic view of an exemplary circuit for effecting selective printing of different characters.

Referring to the drawings, the printer comprises a horizontally extending base 11 spaced from a supporting surface 12 by legs 13. A pair of bearing brackets 14 and 15 are fixed to the base 11 and house ball bearings 16 and 17, respectively. The latter rotatably support trunnion sections of a drive shaft 18. The shaft 18 is rotated at a constant speed by a motor 20 mounted on the base 11 and provided with a pulley 21. A belt 22 is wrapped around the pulley 21 and a pulley 23 fixed to the shaft 18 whereby to drive the latter.

Eccentric sections 24 formed on the shaft 18 support the inner races of ball bearings 25 and 26 whose outer races support a printing drum 27. The drum 27 is hollow and surrounds the shaft 18 without touching the same. The drum has a plurality of adjacent, circumferentially extending rows of type characters 128 spaced therearound and arranged as indicated in the developed view of Fig. 5.

External gears 28 and 29 are formed on the opposite ends of the drum 27 concentrically thereof and these mesh with internal gears 30 and 31 suitably secured in the brackets 14 and 15, respectively. The latter gears are arranged concentric with the shaft 18. The gear 30 is constructed of metal while the gear 31 is constructed of a relatively soft plastic in order to damp out any vibrations set up by the gear teeth, etc., when the printer is operated at relatively high speeds.

Counter weights 32 are fastened to the shaft 18 intermediate the sets of bearings 16, 25 and 17, 26 to balance the eccentrically located drum 27, etc.

As shown in Fig. 5, the drum is divided into two sets of identical numeral type characters ranging from "0" to "9" with two blank spaces 130 between each set, thereby resulting in 24 spaces around the drum. The blank spaces, i.e. 130, are provided for accommodating spacing of the paper as will be described later.

Each of the external gears 28 and 29 is provided with 48 teeth which mesh with 50 teeth formed in the mating internal gears. Accordingly, upon each complete rotation of the shaft 18 and consequent orbital movement of the drum 27 about the center of the shaft 18, the drum 27 will move or creep 1/24 of a complete revolution or from one character position to the next relative to a printing station or point P established by individual printing platens 131 (Fig. 7) aligned with respective ones of the rows of type characters.

The various platens 131 are slideably mounted in side-by-side relation in a guide slot formed in a block 33 extending along the length of the drum 27 and attached to a table 34 supported from the base 11 by brackets 35. Pins 36 and 37 mounted in the block 33 and in an insert 38 in the block, respectively, extend into guide slots 40 and 41, respectively, formed in the platens to both laterally guide the platens and limit their lengthwise movement. Leaf springs 42 are suitably attached to the rear end of the block 33 to normally individually hold the platens in their rearward illustrated positions wherein they will not be engaged by the aligned type characters

on the drum as the latter oscillates toward the printing point.

The various printing platents **131** are connected through stiff rods **44** to armatures **45** (Fig. 8) of print selecting solenoids **46**. The latter are staggered in horizontal tiers, as seen particularly in Figs. 1, 8, 9 and 10. That is, various solenoids **46** are located in a forward group and a rearward group. The rearward group are mounted on a plate **47** suitably attached to the undersurface of the table **34** while the forward group is mounted on a second plate **48** attached to the upper surface of the table **34**.

As shown in Fig. 10. the solenoids **46** are so nested that they extend vertically in inclined rows so that the actuating rods **44**, although bent to connect the various platens **131** with respective ones of the solenoid armatures, extend only in vertical planes.

The paper **50** to be printed is arranged in fanfold strip form and is contained in a supply compartment **51** of a container **52**. Spring fingers **53** guide the paper from the compartment **51** upwardly past the platens **131** and over the forward surface of the block **33**, onto a feed sprocket **54**. The latter is rotatably mounted in bearings formed in side plates **55** and **56** suitably attached to bearing brackets **14** and **15**, respectively. Guide fingers **57** guide the paper **50** over the feed sprocket. Such fingers are formed integral with a bail **58** attached at opposite ends thereof to the side plates **55** and **56**.

The feed sprocket, having sprocket pins **60** thereon engageable in mating perforations in the paper **50**, is intermittently rotated whereby to advance the paper from one printing line to the next. For this purpose, the feed sprocket is connected through a flexible coupling **61** to a shaft **62** which is rotatably mounted in a bearing formed in a transmission unit housing **63**. The shaft **62** is attached to a ratchet wheel **64** (Fig. 4) engageable by a pawl **65** pivoted at **66** on an actuator bail **67** freely mounted on the shaft **62**. A tension spring **167** attached to a tail formed on the pawl **65** normally holds the latter in engagement with the ratchet wheel **64**. A roller **68** on the bail **67** is engageable by a cam **70** keyed on a shaft **71** rotatably mounted in bearings **72** and **73** carried by the housing **63**. The shaft **71** is driven by the aforementioned shaft **18** through a worm and worm wheel pair **74**.

Normally, the bail **67** is held out of cooperative relation with the cam **70** by a latch **75** fulcrummed at **76** and urged into latching engagement with the bail **67** by a tensioned spring **77**. A solenoid **78** is attached to a wall of the housing **63** and has its armature **80** connected to the latch **75** so that upon energization of the solenoid the latch **75** will be released, permitting the bail **67** and its roller **68** to cooperate with the cam **70** whereby to oscillate the pawl **65** and thus incrementally advance the feed sprocket **54** and paper **50**. Upon leaving the sprocket **54** the paper moves downwardly into a second compartment **69** formed in the paper container **52**.

An ink impregnated roller **81** (Fig. 1) extends along the length of the printing drum **27** and is rotatably supported in contact therewith by a spring bracket **82** attached by screws **83** to the base **11**. The roller **81** is formed of felt or other soft porous material whereby to tarnsfer a film of ink onto the surface of the various type characters so that an impression of such characters may be transferred onto the paper **50**.

The operation of the printer will now be described. It will be noted, on reference to Figs. 6 and 7, that the various type characters are each aligned with the pitch diameter of the teeth of the external gears **28** and **29**, or, in other words the type characters are located substantially on a circle having the same diameter as the pitch line of the gears **28** and **29**. Accordingly, as the type drum moves in an orbit about the center *c* of the internal gears **30** and **31**, a part of each type character will describe a hypocycloidal curve as indicated at **84**. It will be seen that as a type character reaches the cusp or apex of its outward travel, it will be moving substantially radially outward. If at this time a platen **131** is positioned inwardly toward the drum **27** by its solenoid, a printing contact will occur to transfer an impression of the selected type character against the paper.

Preferably, the pins **37** (Fig. 9) are so located that the solenoids **46** may position their various platens **131** and aligned portions of the paper at or just inside the apex *a* of the path of the type characters. Thus, when the drum effects a printing contact the platen or platens will yield slightly against the action of their solenoids.

Describing now the means for selecting and timing operation of the various type platens **131**, a commutator, generally indicated at **86**, is provided. The latter comprises a plate **87** of insulating material attached by screws **88** to a forward wall of the transmission housing **63**. The plate has an opening therein through which the shaft **71** extends and the screws **88** extend through curved slots **90** in the plate **87**, the slots extending concentrically of the shaft **71** to permit a slight rotational adjustment of the plate relative to the housing **63**. A wiper arm **91** of insulating material is attached to the shaft **71** and is provided with electrically connected brushes **92** which wipe along a concentric conducting ring **93** and a series of spaced radially extending conductor strips **94** suitably bonded on the surface of the plate **87**.

Fig. 11 illustrates an exemplary circuitry for effecting selective printing from the different type characters. Only three denominational orders of control circuitry are disclosed. However, it should be understood that the remaining orders are identical with those shown.

Each denominational order comprises a series of ten normally open switches **96** representing the digit values "0" to "9," counting downwardly. All like valued movable switch contacts are connected through respective lines of a trunk circuit **97** to different ones of the radial conductor strips **94**. The stationary contacts of the various switches in each order are connected through a line **98** to the grid of a vacuum tube **100**. The cathode of each tube is connected to ground and the anode is connected through a respective print control solenoid **46** to a 375 volt supply line **101**. The grid of each tube is connected through a resistor **106** to a −10 volt line **107** whereby to normally maintain the tube non-conducting.

The wiper strip **93** is adapted to be connected by a normally open relay **102** to a ground line **103**, and the wiper arm **91** is so timed with the printer drum **27** that when the relay **102** is energized and a line of type characters on the drum approaches the printing point, the wiper brushes **92** will apply ground potential to the movable contacts of all like valued switches in all of the different orders. If any such switch is closed, as indicated for example by the No. 5 switch in the right hand illustrated order, the grid of the associated tube **100** will be raised to ground potential, causing the tube to conduct sufficiently to energize the associated platen control solenoid **46**.

Describing now the circuitry for energizing the relay **102** and the paper feed control solenoid **78**, a flip-flop circuit, generally indicated at **104**, the construction of which is well-known in the art, is provided for initiating operation of the printer control circuitry. Normally, the left hand side of the flip-flop is "high." The output of the right hand side of the flip-flop **104** is connected through line **99** to one input of an "and" gate **105** of conventional construction. The second input of the "and" gate is connected to a "start" contact **120** located on the commutator plate **87** and arranged to be wiped by a brush **108** carried on the arm **91**.

When a signal is applied over a line **121** to the left side of the flip-flop **104**, the right hand side thereof becomes "high" to apply a signal to one input of the "and" gate **105**. When the arm **91** passes the No. 9 conductor strip **94**, brush **108** thereon successively connects or bridges a

stop contact **110** on the plate **87** and then the start contact **106** with a grounded contact **111**. Thus, a ground signal is applied to the second input of the "and" gate **105**, causing the latter to apply a signal through line **112** and amplifier **113** to energize the paper feed control solenoid **78**. Simultaneously, a signal is applied through line **112** to the right hand side of a second flip-flop **114** whose right hand is normally "high," thus rendering the left side thereof "high" to apply a control signal through a line **109** to a second "and" gate **115** and to the relay **102**, energizing the latter. The relay is thereafter held energized by the flip-flop **114** throughout the scanning cycle of the wiper arm **91** so that ground potential is successively applied to all of the digit lines in the trunk circuit **97**. At the end of this cycle, the brush **108** engages the stop contact **110**, thereby applying a ground potential along line **119** to the second input of the "and" gate **115**. The latter will then apply a signal over line **116** to the left side of flip-flop **114** and to the right side of flip-flop **104** to return the same to normal conditions wherein the right hand side of the former and the left hand side of the latter are rendered "high."

The commutator plate **87** is preferably so adjusted that each platen, when selected to effect printing, is moved to printing position somewhat in advance of the arrival of a selected type character at the printing point.

It will be noted that an important feature of the present invention is that the above adjustment is not critical, the only requirement being that a platen be advanced after a preceding type character has passed the printing point and that the platen be returned before a subsequent type character approaches the printing point. Thus, the platen is stationary when struck by a selected type character. However, the plate can, if desired, be so adjusted that the platens will advance and strike the selected type characters, through the paper, just as the type characters reach the printing point. In either event, it will be noted that when a platen presses against a selected type character, the latter appears, in effect, to be standing still as far as rotation of the drum is concerned. This permits a wide tolerance in the timing of the actuation of the different platens. Also, it will be seen that a straight line of typed characters will result even though such relatively wide differences in timing of the actuation of the different platens may occur.

Although we have described our invention in detail in its preferred embodiment and have therefore used certain specific terms and languages herein, it is to be understood that the present disclosure is illustrative rather than restrictive and that certain changes and modifications may be made without departing from the spirit or scope of the claims appended hereto.

Having thus described the invention, what we desire to secure by United States Letters Patent is:

1. A printing mechanism comprising a printing drum having a plurality of different type characters therearound, means for oscillating the center of said drum while continuously rotating said drum about said center, said last mentioned means advancing said drum from one of said type characters to another during each oscillation, and means for effecting an impression of a selected one of said type characters against a record medium at a predetermined point in said oscillation.

2. A printing mechanism comprising a printing drum having a plurality of different type characters spaced therearound, a printing platen, means for guiding a record medium intermediate said platen and said drum, means for oscillating the center of said drum relative to said platen while continuously rotating said drum about said center, said last mentioned means advancing said drum from one of said type characters to another during each oscillation, and means for normally maintaining said platen away from said drum and for moving said platen toward said drum when a selected type character approaches said platen whereby to impress said selected type character against said record medium.

3. A printing mechanism comprising the combination of a printing drum having a plurality of different type characters spaced therearound, a printing platen, means for guiding a record medium intermediate said platen and said drum, means for bodily oscillating the center of said drum in one direction relative to said platen while rotating said drum to cause said type characters to move in an opposite direction and at a rate of speed such that a new type character is presented to said record medium during each cycle of oscillation of said type drum, and means for normally maintaining said platen away from said drum and for moving said platen toward said wheel when a selected type character approaches said platen whereby to impress said selected type character against said record medium.

4. A printing mechanism comprising the combination of a cylindrical printing drum having a plurality of different type characters spaced therearound, a printing platen, means for guiding a record medium intermediate said platen and said drum, means for moving the center of said drum in an orbital path while rotating said drum about said center to cause said type characters to move at a rate such that a new type character is presented to said record medium during each complete orbital movement of said drum center, and means for normally maintaining said platen away from said drum and for moving said platen toward said drum when a selected type character approaches said platen whereby to impress said type character against said record medium.

5. A printing mechanism comprising the combination of a fixed internal gear, a cylindrical member having type characters spaced therearound, an external gear integral with said cylindrical member, said external gear having a smaller pitch circle than that of said internal gear, means for moving the center of said cylindrical member in a circular path whereby to maintain said gears in mesh, a printing platen, means for guiding a record medium intermediate said cylindrical member and said platen, and means for normally maintaining said platen away from said member and for moving said platen toward said member when a selected type approaches said platen whereby to transfer an impression of said selected type character onto said record medium.

6. A printing mechanism comprising the combination of a stationary internal gear, an external gear rotatable in a planetary movement in mesh with said internal gear, a cylindrical type member concentric and integral with said external gear, said type member having type characters spaced therearound, the ratio of the diameter of said external gear with that of said internal gear being such that said type member will advance from one of said type characters to the next during each planetary movement of said external gear, a platen, means for guiding a record medium between said type member and said platen, and means for moving said platen toward said type member when a selected type character approaches said platen whereby to transfer an impression of said selected type character against said record medium.

7. A printing mechanism comprising the combination of a stationary internal gear, an external gear rotatable in a planetary movement in mesh with said internal gear, a cylindrical type member concentric and integral with said external gear, said type member having a plurality of rows of type characters thereon, a ratio of the diameter of said external gear to that of said internal gear being such that said type member will advance from one of said type characters to another during said planetary movement of said external gear, a plurality of platens aligned with respective ones of said rows of type characters, means for guiding a record medium between said type member and said platens, and means for moving said platens toward said type member when selected type characters approach respective ones of said platens where-

by to effect impression of said selected type characters against said record medium.

8. A printing mechanism comprising the combination of a rotatable cylindrical type member having a plurality of type characters spaced therearound, a bearing member rotatably supporting said type member, means supporting said bearing member for rotation about an axis eccentric to the axis of rotation of said type member, a stationary internal gear concentric with the axis of rotation of said bearing member, an external gear integral with said type member and rotatable in a planetary movement in mesh with said internal gear upon rotation of said bearing member, the ratio of the numbers of teeth of said gears being such that said type member will advance from one of said type characters to another during each planetary movement of said external gear, and means for obtaining an impression of a selected one of said type characters.

9. A printing mechanism comprising the combination of a rotatable type member having a plurality of type characters spaced therearound, a bearing member rotatably supporting said type member, means supporting said bearing member for rotation about an axis eccentric to the axis of rotation of said type member, a stationary internal gear concentric with the axis of rotation of said bearing member, an external gear integral with said type member and rotatable in a planetary movement in mesh with said internal gear upon rotation of said bearing member, the ratio between the numbers of teeth of said gears being such that said type member will advance from one of said type characters to another during each planetary movement of said external gear, a platen for a record medium located adjacent said type member, and means for advancing said platen toward said type member when a selected type character approaches said platen whereby to obtain an impression of said selected type character on said record medium.

10. A printing mechanism comprising the combination of a hollow type member having a plurality of type characters around the outer periphery thereof, a shaft extending through said type member, means on said shaft supporting said type member for rotation about an axis eccentric to the axis of said shaft, means for rotatably supporting said shaft for rotation about the axis thereof, a stationary internal gear concentric with said shaft, an external gear on said type member and meshing with said internal gear, said external gear extending concentric with said type member, the ratio between the numbers of teeth of said gears being such that said type

member will advance from one of said type characters to another relative to a printing point during each planetary movement of said external gear and said type member, and means for obtaining an impression of a selected one of said type characters at said printing point.

11. A printing mechanism comprising the combination of a hollow cylindrical type member having a plurality of rows of type characters around the outer periphery thereof, a shaft extending through said type member, bearings on said shaft for rotatably supporting said type member for movement about an axis eccentric to the axis of said shaft, means supporting said shaft for rotation about the axis thereof, a stationary internal gear concentric with said shaft, an external gear integral with said type member and meshing with said internal gear, said external gear extending concentric with said type member, the ratio of the numbers of teeth of said gears being such that said type member will advance past a printing station from one of said type characters to another during each planetary movement of said external gear, a plurality of platens aligned with respective ones of said rows of type characters, means for guiding a record medium between said type member and said platens, and means for moving selected ones of said platens toward said type member when selected type characters approach said printing station whereby to effect impression of said selected type character against said record medium.

12. A printing mechanism comprising the combination of a cylindrical printing member having a plurality of different type characters spaced therearound, means for rotating said drum about the axis thereof while moving said drum in an orbital path about said axis whereby to cause said type characters to move past a printing station at a rate such that a new type character is presented to said printing point during each complete orbital movement of said drum, a printing platen, means for guiding a record medium intermediate said platen and said drum and past said printing point, and means for yieldably positioning said platen adjacent said printing point when a selected type character approaches said printing point whereby to impress said type character against said record medium.

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