United States Patent [19]

Busch

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[45] **Apr. 8, 1975**

[54] **HIGH SPEED PRINTER**

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[73] Assignee: **Addmaster Corporation,** San Gabriel, Calif.

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[52] **U.S. Cl.** **101/99;** 101/93.28

[51] **Int. Cl.** **B41j 1/48**

[58] **Field of Search** ..... 101/93 C, 95, 99; 197/18, 197/51

[56] **References Cited**

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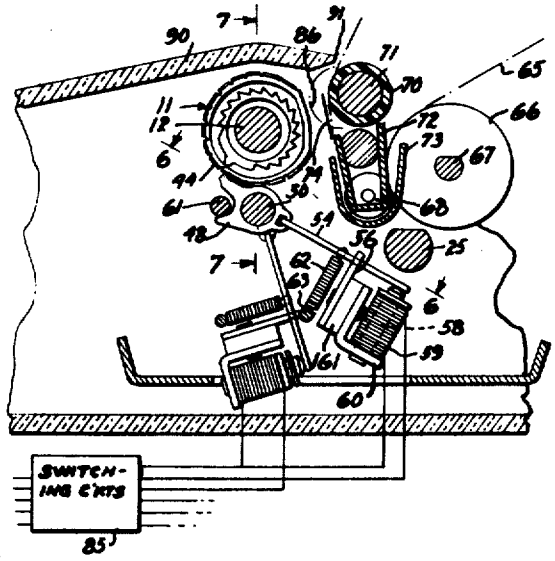
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Primary Examiner—Edgar S. Burr
Assistant Examiner—Paul T. Sewell
Attorney, Agent, or Firm—Fred N. Schwend

[57] **ABSTRACT**

A cyclically operable high speed data printer comprising a plurality of type wheels supported and yieldably driven by a drive shaft, each wheel having character position stops and a home stop. The drive shaft is driven through two revolutions in the same direction for each cycle. During the first revolution, stop devices are spring actuated at different times to engage certain of the character position stops to arrest the type wheels in different type printing positions. Printing occurs after the first revolution, and during the second revolution, the stop devices are positioned to arrest the home stops whereby to locate the wheels in their home positions.

3 Claims, 9 Drawing Figures



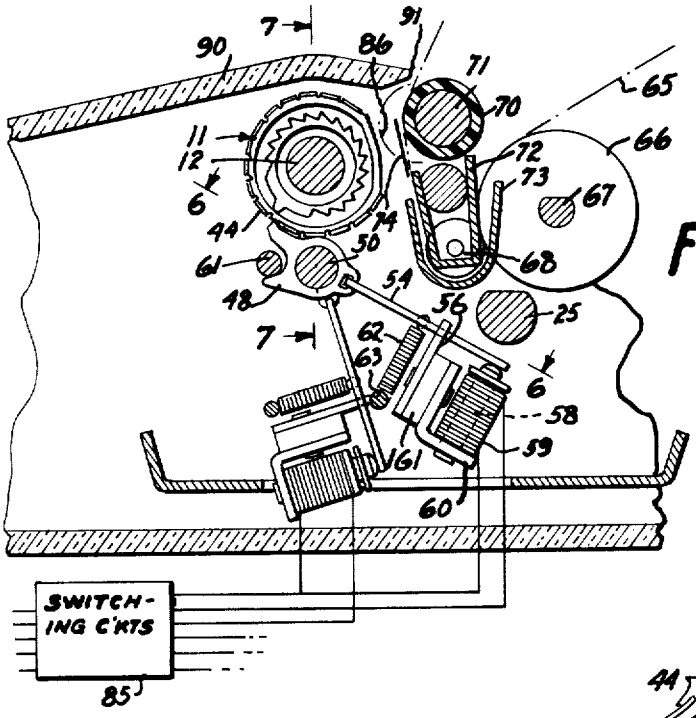


FIG. 1.

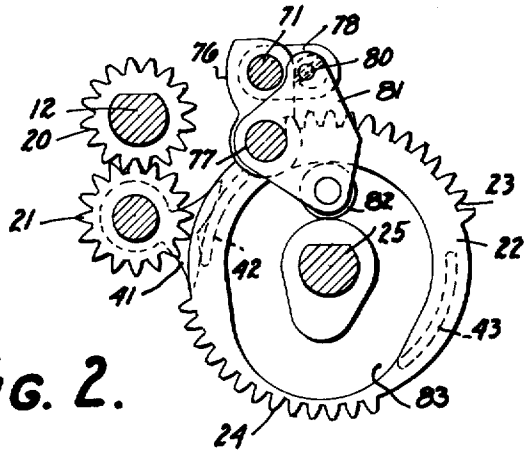


FIG. 2.

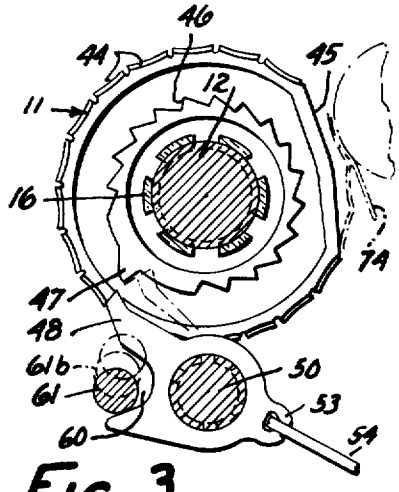


FIG. 3.

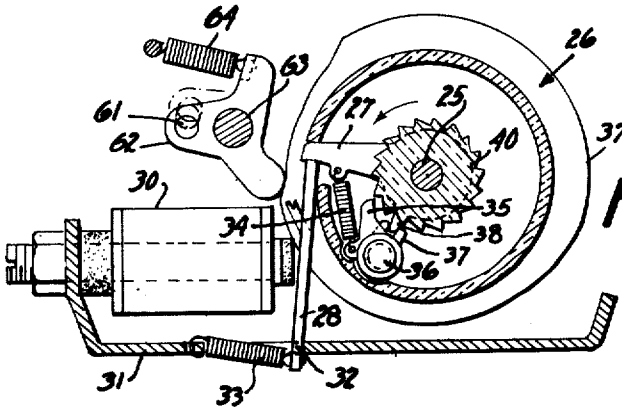


FIG. 4.

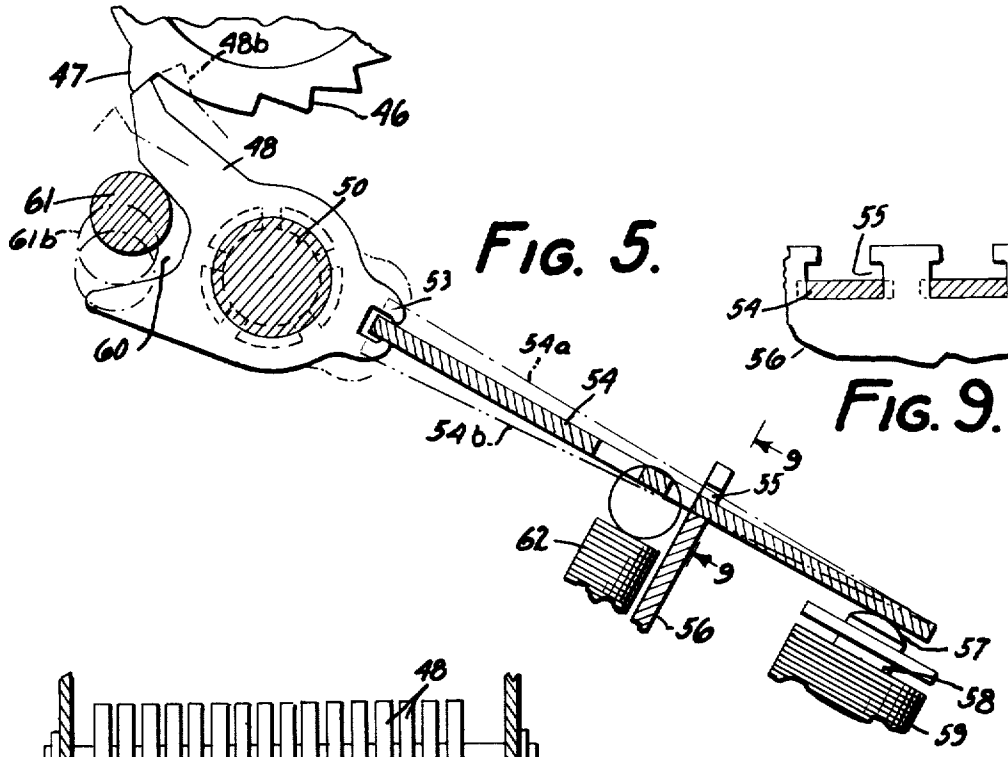


FIG. 5.

FIG. 9.

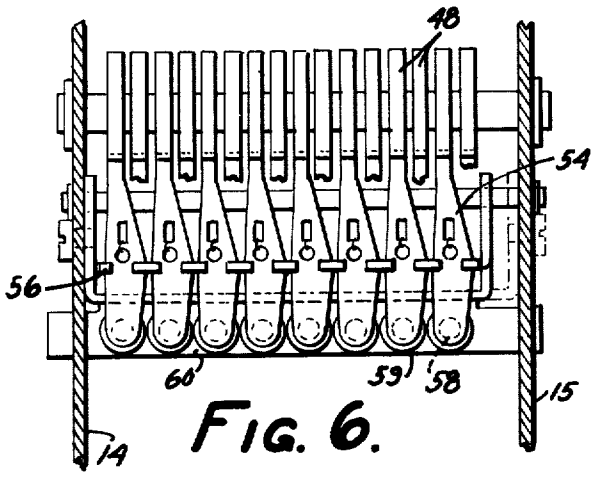


FIG. 6.

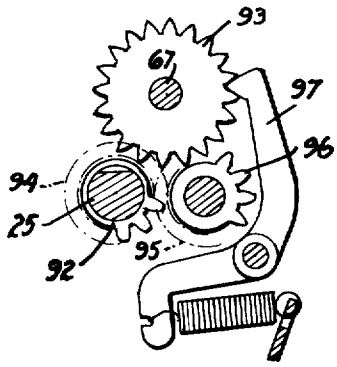


FIG. 8.

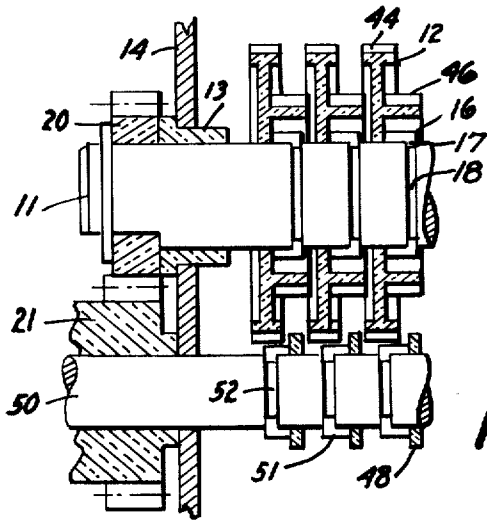


FIG. 7.

HIGH SPEED PRINTER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to high speed data printers and has particular reference to printers of the type comprising a plurality of axially aligned, yieldable rotated type wheels which are arrested at different times to position different type characters at a printing line.

2. Description of the Prior Art

In printers of the above type, the type wheel stop device must be accurately timed in order to selectively stop the wheels to present selected type characters at the print line. Thus, the speed of the printer, as well as its reliability, is to a large extent limited by the timing accuracy of the stop device. Heretofore, such stop devices have generally been operated by electromagnets, each of which, when energized, must operate against the action of a return spring and must be held energized until the printing operation has been completed.

In such cases, the air gap between the armature of the stop device and the electromagnet is initially at its greatest distance. Therefore, the electromagnet is weakest at this time and requires a relatively large amount of current to be passed through its winding in order to quickly actuate the stop device. In addition, such electromagnet must operate against both the action of the return spring and the initial static friction of the operating parts of the stop device. Accordingly, timing of the stop device tends to become inconsistent. Further, the timing may be affected by temperature changes in the winding due to ambient temperature changes and due to the fact that the winding must be held energized throughout a relatively large portion of the printing time in each cycle so that during repeated cycling of the printer the temperature of the windings may continually increase. Since the electromagnet exerts the least amount of force at the beginning of its stroke and since static friction in the stop device is greatest at this time, and since the temperature of the windings may vary considerably due to their relatively long duty cycles, it will be seen that inaccuracies in timing can easily occur.

SUMMARY OF THE INVENTION

According to the present invention, the stop device for each type wheel is urged toward arresting engagement with the type wheel by a tension spring but is normally held in a retracted or cocked position by a magnet which holds the stop device through magnetic attraction. A coil is provided which is only momentarily pulsed in such a manner as to buck or reduce the magnetic flux in the magnet to allow the spring to impel the stop device against the type wheel. The magnetic flux of the magnet is preferably of such strength that once the stop device releases from the magnet, the flux will be incapable in itself of retracting the latter. Thus, only a small momentary amount of current is required to release the stop device so that heating of the coil is minimal. The spring at this time exerts a maximum amount of force. Therefore, the size of the coil may be held to a minimum and since the spring is not effected by any temperature changes, variations in current, etc., a more consistent timing operation is insured.

The drive shaft supporting the type wheels is intermittently driven through two successive revolutions. During each cycle, the type wheels are differentially arrested by the stop device in selected positions while the drive shaft is rotating through its first revolution and printing occurs shortly thereafter. During the second revolution, the stop devices are located to arrest the type wheels in their home positions, preparatory for a new printing operation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional elevation view of a printer embodying a preferred form of the present invention.

FIG. 2 is a sectional elevation view illustrating the drive mechanism for the type wheels.

FIG. 3 is an enlarged sectional view illustrating a type wheel and stop pawl associated therewith.

FIG. 4 is a sectional elevation view showing the main clutch and controls therefor.

FIG. 5 is an enlarged sectional view illustrating the controls for a typical stop pawl.

FIG. 6 is a transverse sectional view taken substantially along the line 6—6 of FIG. 1.

FIG. 7 is an enlarged transverse sectional view taken along the line 7—7 of FIG. 1.

FIG. 8 is a sectional view illustrating part of the paper feed mechanism.

FIG. 9 is a fragmentary sectional view taken along line 9—9 of FIG. 5.

DETAILED DESCRIPTION OF THE EMBODIMENT

Referring to the drawings, a plurality of type wheels 11 (FIGS. 1, 3 and 7) are rotatably mounted on a type wheel shaft 12 which is rotatably mounted in bearings, one of which is shown at 13, supported by spaced side frames 14 and 15.

The shaft 12 is rotated counterclockwise two revolutions during each cycle of the printer and in order to yieldably drive the type wheels, each such wheel has a series of laterally extending spring fingers 16 (FIGS. 3 and 7) which frictionally engage the shaft and terminate in inwardly extending tips 17 fitting in circumferentially extending grooves 18 in the shaft. The fingers 16 thus also act to locate the type wheels in laterally spaced relation.

For the purpose of rotating the shaft through two revolutions during each cycle of the printer, the shaft 12 carries a gear 20 (FIG. 2) meshing with a second gear 21 meshable with an interrupted gear 22 having two diametrically opposed sets of gear teeth 23 and 24. Gear 22 is carried by a main drive shaft 25 (see also FIG. 4) suitably rotated in bearings carried by the side frame plates 14 and 15.

A motor-driven cyclic clutch generally indicated at 26 is provided to rotate the shaft 25 one revolution during each cycle of the printer. The clutch comprises an arm 27 attached to shaft 25 and normally blocked in its position shown by the armature 28 of an electromagnet 30 supported by a cross brace 31 of the printer.

When the electromagnet 30 is energized to initiate a cycle of the printer, the armature 28 is rocked counterclockwise about a pivot support 32 against the action of a tension spring 33 to release the arm 27 to the action of a spring 34 tensioned between the arm and a pawl 35. The latter is pivoted at 36 on a combined clutch and cam member 37 fastened on the shaft 25. The pawl 35 has a pair of fingers 35 which embrace a tooth 38 on the arm 27. Thus, when the arm 27 is rocked counterclockwise by its spring 34, the pawl 35 will be rocked clockwise causing the same to engage a

motor-driven ratchet wheel **40** which is rotatable mounted on the shaft **25**. At the end of the revolution of shaft **25** the arm **27** will be arrested by the armature **28**.

The shaft **12** and type wheels **11** are held immobile when not being driven by the gear sets, **23** and **24**. For this purpose, a shoe **41** (FIG. 2) is attached to the gear **21** and engages one of two arcuate sleeves **42** and **43** formed on the gear **22** when the gear **21** becomes disengaged from either of the gear sets **23** and **24**.

Each of the type wheels **11** has a series of type characters **44** spaced therearound, the series being interrupted by an undercut section **45**. Each wheel **12** has a series of character position stop teeth **46** therearound, one for each of the type characters. Also, a single home position stop tooth **47** is provided which extends a greater radial distance from the shaft **12** than do the stop teeth **46**.

Each type wheel **11** has a stop pawl **48** associated therewith, the latter being freely pivoted on a pawl support shaft **50**. The pawls **48** are laterally spaced from each other by means of laterally extending fingers **51** (FIG. 7) which engage circumferentially extending grooves **52** formed in the shaft **50**.

Each pawl **48** has a pair of jaws **53** which embrace one end of a magnet armature **54**. The latter is freely fulcrumed intermediate its ends in a notched portion **55** (FIGS. 5 and 9) of a support plate **56** which forms part of a magnet frame. Thus, the portion of the plate **56** underlying the armature **54** forms a fulcrum for the armature. As seen in FIG. **9**, the notched portion **55** permits a limited lateral movement of the armature **54**. The opposite end of the armature **54** rests against a rounded end portion **57** of a core piece **58** attached to an angle piece **60** which, in turn, is attached to a permanent magnet **161** to which is also attached the support piece **56**. The portion **57** forms a second fulcrum for the armature **54**. The magnet **161** and parts **58**, **60** and **56**, form a magnet frame which develop sufficient magnetic flux to normally hold each armature **54** in engagement with the end face **57** of its core piece **58** against the action of a tensioned spring **62** extending between the armature and a tie rod **63**.

Electromagnets **59** are mounted on the core pieces **58** for the purpose of bucking or neutralizing the magnetic flux produced by the magnet **161** as will be described later.

The magnet frames and their armatures **54** are divided in two interspersed groups as seen in FIGS. **1** and **6** to provide sufficient lateral room.

The stop pawls **48** have cut-out sections **60** which straddle a bail rod **61** (FIGS. **1**, **3**, **4** and **5**) which is carried at its ends by levers, one of which is shown at **62**, pivotally supported at **63**, and held in engagement with the cam **37** by a relatively strong tension spring **64**.

A paper strip indicated by dot-dash lines **65** is fed from a suitable supply roll (not shown) and passes over a feed roller **66** carried by a shaft **67**, under a guide roller **68** and over a rubber platen roller **70** which is mounted on a platen shaft **71**.

A paper guide chute formed by nested U-shaped guide members **72** and **73** facilitate threading of the strip and also guides the latter behind a suitably supported inked printing ribbon **74**.

Means are provided to cause the platen roller **70** to impress the paper stip against aligned ones of the type characters **44** on those type wheels which have been advanced from their home positions illustrated in FIGS. **1** and **3**. For this purpose, the platen shaft **71** is carried at its ends by levers **76** fixed on a rockable cross shaft **77** and connected by links **78** and eccentric adjustment screws **80** to cam follower levers **81** pivoted on the shaft **77**. One of the cam followers **81** carries a roller **82** engaging in a cam way **83** formed in the aforementioned gear **22**.

Normally, when the machine is in its illustrated full cycle position, the electromagnets **59** are deenergized. The spring **64** and cam **37** maintain the bail rod **61** in its lowermost rocked position shown in full lines in FIGS. **1** and **3**, to hold the stop pawls **48** out of blocking relation with both the home position stop teeth **47** and the character position stop teeth **46** of the type wheels **11**. In this condition, the armatures **54** will be held in their dot-dash line positions **54a** (FIG. **5**) where they are fulcrumed on the end faces **57** of core pieces **58** and are raised slightly from their fulcrums **55** against the action of springs **62**.

Approximately 30° after the start of the printer cycle, the set of gear teeth **23** of gear **22** will mesh with gear **21** to cause shaft **12** to rotate the type wheels **11** counterclockwise. The home stop teeth **47** will thus pass over the tips of the stop pawls **48**. Shortly thereafter, the cam **37** will cause the bail rod **61** to rise to its uppermost position shown in full lines in FIG. **5**, positioning stop pawls **48** and armatures **54** and in their full-line positions shown in that figure wherein the armatures seat against both fulcrums **55** and **57**. In this position, the stop pawls **48** are located slightly above the level of the stop teeth **46**.

The electromagnets **59** are energized at different times by suitable switching circuits **85** when selected type characters **44** approach the printing line indicated at **86**. The electromagnets need only be momentarily energized in a direction to at least partly overcome or neutralize the magnetic flux exerted by the respective magnet cores **58**, etc., so as to allow the springs **62** to rock the armatures **54** counterclockwise about their fulcrums **55** into their alternate positions shown by dot-dash lines **54*b*** so as to rock their stop pawls **48** into arresting positions **48*b*** wherein they will arrest stop teeth **46** and thus the type wheels **11** in positions aligning the selected type characters with the printing line **86**. Once the armatures **54** have been released from their core pieces **58**, the flux produced by the permanent magnet **61** will be of insufficient strength in itself to return the armatures.

In those orders where no printing is to occur, the print wheels will have made a complete revolution so that their under-cut portions **45** will be aligned with the printing line, as shown in FIG. **3**. In such case, the stop teeth **47** will arrest against the associated stop pawls **48**.

As the shaft **12** completes its first revolution, the camway **83** of gear **22** causes the platen roller **70** to momentarily press the paper strip **65** and printing ribbon **74** into printing contact with the aligned type characters.

As the platen roller **70** is retracted from printing contact, the cam **37** causes the bail rod **61** to move into its intermediate position **61*b*** and in doing so it picks up the stop pawls **48** to return them and the armatures **54** into their full-line positions shown at FIG. **5** wherein the armatures will again engage the magnet cores **58** to be retained by the magnetic latching effect of the magnetic flux produced by the magnet **161**. The stop pawls

48 will now be in position to arrest the home stop teeth 47 and thus locate the type dials 11 in their home positions. At this time, the second set of gear teeth 24 will mesh with gear 21 and thus will rotate the shaft 12 and type wheels counterclockwise until the type wheels are arrested in their home positions.

After the shaft 12 has completed its second revolution, and just before completion of the printer cycle, the cam 37 will again enable the spring 64 to lower the bail rod 61 into its lowermost position shown in full lines in FIGS. 1 and 3 to likewise rock the stop pawls 48 into their full-line positions shown in such figures. In so doing, the armatures 54 are raised into their positions 54*a* (FIG. 5) against the action of springs 62 to insure that the opposite ends of the armatures definitely engage the magnet cores 58 to be magnetically latched thereby.

As shown in FIG. 1, a printer housing 90 is provided which extends over the type wheels 11 and terminates in a tear-off edge 91 located directly adjacent the platen roller 70. For the purpose of facilitating viewing of the last amount printed on the strip 65, the strip is retracted three line spaces prior to printing and, after such printing operation, it is advanced four line spaces so as to be readily viewed above the tear-off edge 91. To accomplish this, an interrupted gear 92 (FIG. 8) having three teeth is carried by the drive shaft 25 and is effective to mesh with and drive a gear 93 carried by the paper feed shaft 67 three increments in a clockwise direction. The teeth of gear 92 are so located angularly about the shaft 25 that they will cause retraction of the strip 65 by the feed roller 66 during the first revolution of shaft 12, while the type wheels, 11 are being differentially positioned to selected type character positions.

Shaft 25 is entrained through a pair of intermeshing gears 94 and 95 with a second interrupted gear 96 having four gear teeth thereon. The latter teeth are so angularly located that they will drive the gear 93 counterclockwise after the printing operation, and during the second revolution of the shaft 11, so as to advance the paper stip 65 until the last printed amount will be located above the tear-off edge 91. A spring pressed detent 97 engages the gear 93 to hold the paper feed roller 16 in any position to which it is advanced.

I claim:

1. A cyclically operable printing apparatus comprising
- a rotatable type wheel having type characters spaced therearound,
- character position stops on said wheel,
- a home position stop on said wheel,
- means including a driven gear for yieldably driving said type wheel;
- means including an interrupted gear having two spaced sets of gear teeth for intermittently rotating said driven gear,
- means for rotating said interrupted gear during each cycle of said printing apparatus,
- a stop device,
- means operable during rotation of said driven gear by a first one of said sets of gear teeth to locate said stop device in position to arrest one of said character position stops whereby to locate a selected one of said type characters at a printing line,
- printing impression means for thereafter printing said selected type character on a record medium, and
- means operable during rotation of said drive gear by said second set of gear teeth to locate said stop device in position to arrest said home stop.

2. Printing apparatus comprising
- a rotatable type wheel having type characters spaced thereon,
- character position stops on said wheel,
- said stops being all located at the same radial distance from the axis of said wheel,
- a home stop on said wheel,
- said home stop being located at a different radial distance from said axis than said character stops,
- means for rotating said wheel in one direction only,
- first and second fulcrums,
- a stop pawl,
- a magnet armature connected to said stop pawl,
- magnet means normally maintaining said armature in engagement with said first fulcrum,
- yieldable means normally maintaining said armature in engagement with said second fulcrum,
- said armature maintaining said stop pawl in the path of said home stop when said armature is in engagement with both of said fulcrums,
- means for rocking said armature about said first fulcrum whereby to locate said stop pawl out of the path of all of said stops, and
- means for at least reducing the magnetic flux of said magnet means to enable said yieldable means to move said armature about said second fulcrum whereby to locate said stop pawl in the path of one of said character position stops.

3. Printing apparatus according to claim 2 wherein said first fulcrum comprises a magnet frame for inducing a magnetic flux in said armature.

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