# United States Patent [19]

**Clary**

[11] **3,916,786**

[45] **Nov. 4, 1975**


[54] **DRUM SERIES PRINTER WITH TYPE MEMBERS ARRESTED BY STAGGERED STOP PAWLS**


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



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[21] Appl. No.: **450,846**

[52] **U.S. Cl.** ..... **101/93.37**; 101/93.22; 101/99

[51] **Int. Cl.**[2] ..... **B41J 1/08**

[58] **Field of Search** ..... 101/95, 99, 110, 93.18, 101/93.22, 93.23, 93.24, 93.25, 93.37, 93.41



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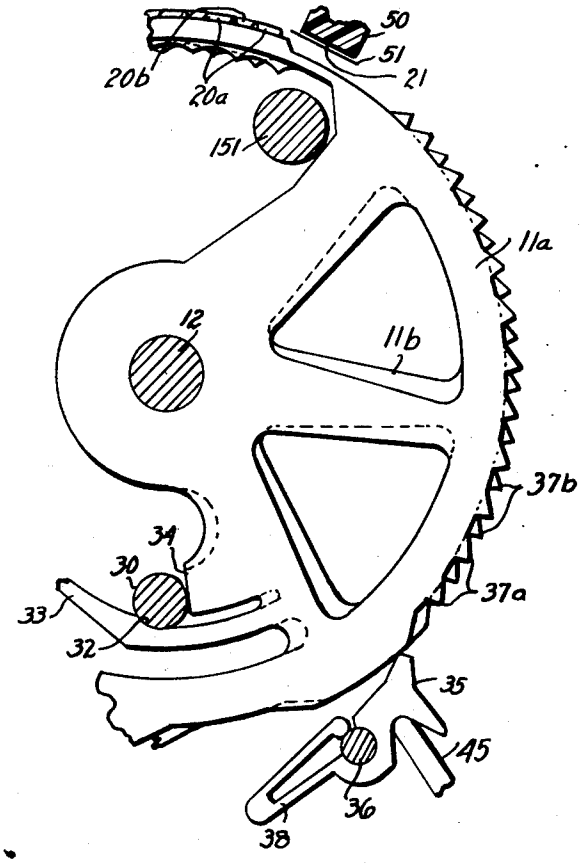
*Primary Examiner*—Edgar S. Burr
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[57] **ABSTRACT**

A plurality of type carriers having spaced type characters and stop teeth thereon are yieldably driven past a printing station and are arrested by engagement of electromagnetically controlled stop pawls with selected ones of the stop teeth. The type characters and stop teeth on certain of the type carriers are staggered relative to the type characters and stop teeth on other type carriers to reduce the mechanical "break-away" load and the electrical load.


**7 Claims, 6 Drawing Figures**



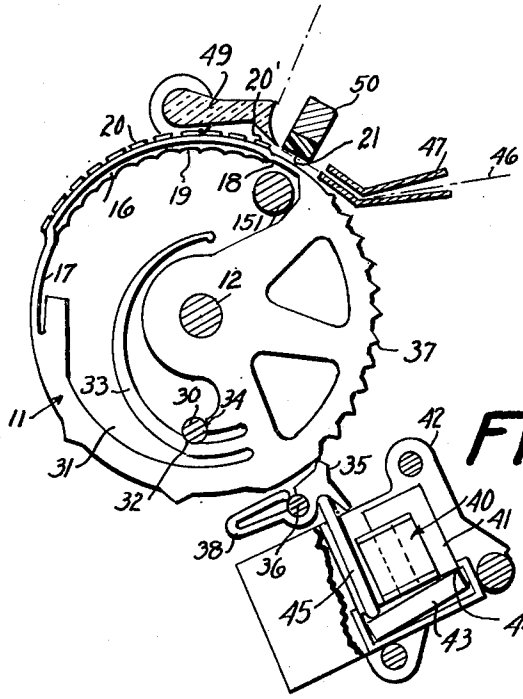

49
20'
50
20
21
47
46
16
19
18
151
17
12
37
33
30
34
11
31
32
42
35
40
41
38
36
45
43
44

FIG. 1.

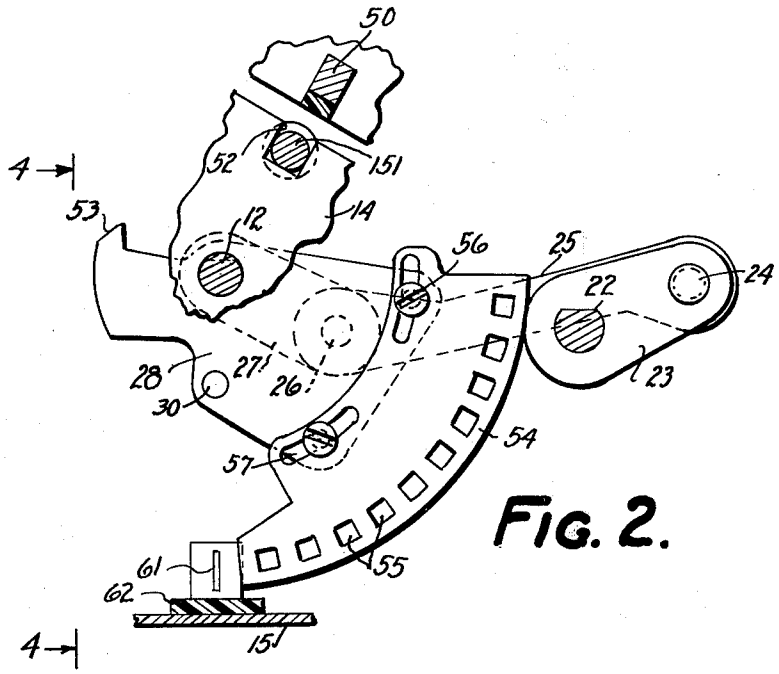

50
52
151
4
53
12
14
56
25
22
24
28
27
26
30
23
54
57
61
62
55
15
4

FIG. 2.

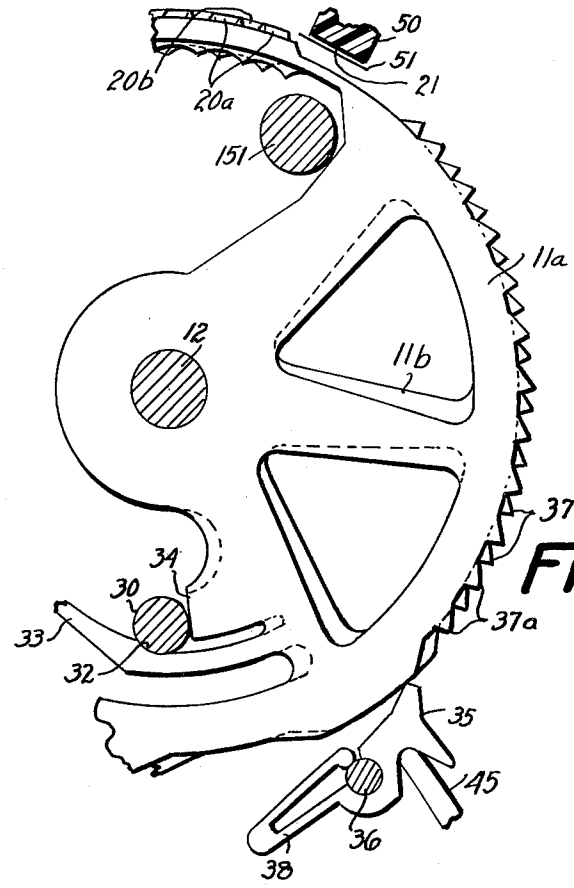



FIG. 3.

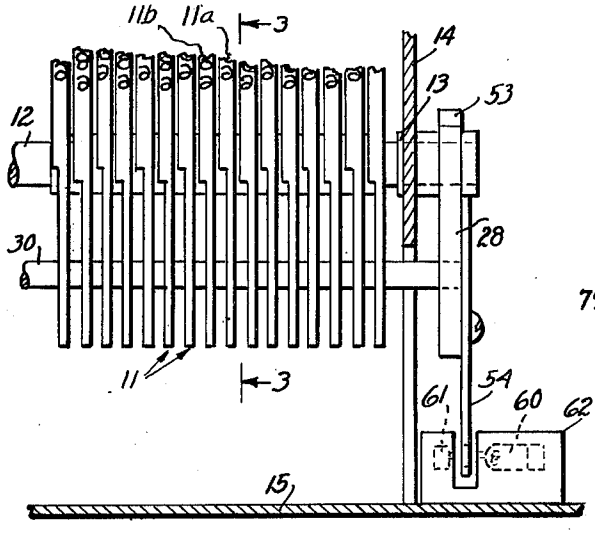



FIG. 4.

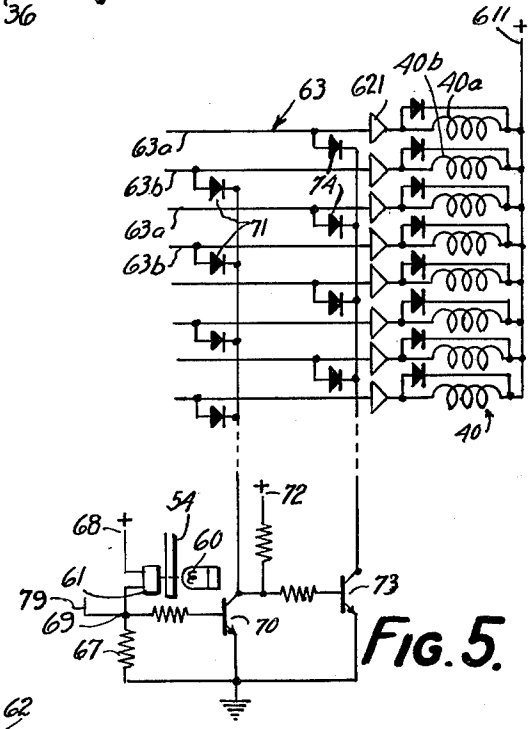



FIG. 5.

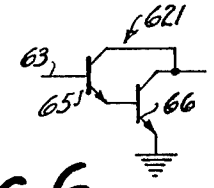



FIG. 6.

# DRUM SERIES PRINTER WITH TYPE MEMBERS ARRESTED BY STAGGERED STOP PAWLS

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to data printers and has particular reference to printers of the type embodying a series of differentially positionable type members, each carrying a set of type characters. Such members are yieldably advanced past a printing station and are arrested at different times to position selected type characters to be printed.

2. Description of the Prior Art

Printers of the above type generally comprise yieldably operated devices for advancing the type members until they are arrested by settable stop pins or pawls. In cases where the type members are driven through extensible springs, the springs at certain times, depending on the positions in which the type members are arrested, must be stretched a maximum amount. Since printers of this type may incorporate as many as 16 denominationally arranged type members, and since the springs must operate properly when in their most collapsed conditions, the aggregate load applied to all actuator springs when stretched to their maximum amount may require an abnormally large power drive unit.

In order to reduce the power required, detent drive mechanisms, such as that disclosed and claimed in the B. F. Kuhne U.S. Pat. No. 3,094,278 have been developed. Such drive mechanisms have proved superior since the "break-away" force or that force necessary to uncouple a type member or other driven element from the drive means is the same regardless of when the break-away occurs.

Although such detent drive type actuators are highly satisfactory in reducing the amount of power required to drive the various type members or the like, there are certain times, i.e. when all type members are arrested at the same time to locate the same type elements at the printing station, that an abnormal instantaneous or peak load occurs which often becomes the determining factor as to the size of the power drive unit. Although a relatively weak drive motor can be used under most conditions where the break-away occurs at different times in the different denominational orders, when such break-away occurs simultaneously in all or most orders, it may momentarily slow down the drive motor and could possibly stall the same.

Further, in cases where electromagnetically operated stop pawls are employed to arrest the type members or the like, simultaneous actuation of all of the stop pawls also presents an abnormal or peak electrical load which dictates the size of the electrical power supply necessary to energize all of the electromagnets for operating or controlling the pawls. This is of particular importance where the printer is associated with data processing equipment, such as an electronic calculator, which incorporate integrated circuits or the like, wherein relatively feeble control currents are encountered.

## SUMMARY OF THE INVENTION

A principal object of the present invention is to reduce abnormal or peak mechanical and/or electrical loads encountered in differentially driving type members or the like in printers of the above type.



Another object is to enable relatively small drive motors to be employed for printers of the above type.

According to the present invention, denominationally arranged type members, each carrying a set or font of type characters, are advanced past the printing station by a common drive member through yieldable connections, such as of the spring detent type, and are arrested by electromagnetically operated pawls.

Certain of the type members are staggered relative to others so that even when the same characters are to be printed in all or a large number of denominational orders, the stop pawls in certain orders may be actuated at different times and therefore the instantaneous or peak electrical load required to actuate all pawls is significantly reduced, thereby requiring a smaller electrical power unit. Further, since the "break-away" point is different for certain of the type members, the instantaneous mechanical load occasioned by the arresting of a number of the type members at the same type character positions will also be reduced considerably and therefore a much weaker and less expensive drive motor need be used.

## BRIEF DESCRIPTION OF THE DRAWINGS

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 elevation view of a data printer embodying a preferred form of the present invention.

FIG. 2 is a sectional view illustrating the drive mechanism for the printer.

FIG. 3 is an enlarged fragmentary view illustrating the staggered relation of certain of the printing sectors and is taken along line 3—3 of FIG. 4.

FIG. 4 is a transverse sectional view through part of the printer and is taken substantially along the line 4—4 of FIG. 2.

FIG. 5 is a schematic diagram of the electrical control circuits for the stop pawl actuating coils.

FIG. 6 is a detailed schematic view of one of the drive circuits for a stop pawl actuating coil.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, the printer disclosed therein comprises a plurality of plastic printing sectors 11 arranged in side-by-side relation. The sectors 11 are pivotally mounted independently of each other on a rockable support shaft 12 rotatably supported in bearings 13, FIG. 4, carried by spaced printer side frames, one of which is shown at 14. Such side frames are suitably secured to a base frame 15.

Each sector 11 has a somewhat flexible arcuate type section 16 which is integrally connected to the main body of the sector 11 by end portions 17 and 18 of greater flexibility than that of the main part of the section 16. Printing type characters 20 ranging in value from a zero type character 20' are spaced along the length of the type section 16.

Means are provided to yieldably advance the various type sectors 11 clockwise from their illustrated initial or home positions until differentially arrested in positions presenting selected type characters 20' or 20 at a printing station 21. After a printing impression, as will be described later, the sectors are returned counter-

clockwise to their home positions. For the purpose of moving the sectors **11**, a cyclically operable drive shaft **22**, FIG. **2**, is provided which is suitably driven clockwise one revolution for each cycle of the printer. An arm **23** carried by shaft **22** is pivotally connected at **24** to a link **25** which, in turn, is pivotally connected at **26** to an arm **27** attached to the shaft **12**.

Cam arms, one of which is shown at **28**, are fastened to the shaft **12** and carry the opposite ends of a bail rod **30** which extends through openings **31** in the sectors **11** and frictionally engages depressions **32** formed in yieldable tails **33** formed integral with the sectors **11**. The bail rod **30** also rests against shoulders **34** formed on the sectors **11**. As the drive shaft **22** and arm **23** move clockwise through the first half of a revolution, link **25** and arm **27** rock the shaft **12** and thus carry the bail rod **30** through approximately 90° to yieldably drive the various sectors **11** correspondingly.

Means are provided to selectively arrest the different type sectors **11** so as to present selected type characters **20** at the printing station **21**. For this purpose, a stop pawl **35** is provided for each sector **11**. The pawls **35** are independently pivoted on a rod **36** and are adopted to engage any of a plurality of spaced stop teeth **37** found on the sectors **11**. Each stop pawl **35** is frictionally held in either its illustrated retracted position or in a blocking position in engagement with one of the teeth **37** of its associated sector **11** by means of a spring tail **38** which is formed integral therewith and frictionally engages the rod **36**.

The stop pawls **35** are moved into blocking relation with the sectors **11** by electromagnetic coils **40**. For this purpose, each coil **40** surrounds one leg of a U-shaped magnet core **41**, FIG. **1**, and is mounted within a plastic housing **42**. Upon energization of a coil **40**, an armature **43** pivoted at **44** is attracted upwardly and in so doing forces a rod **45** upwardly to rock the associated pawl **35** into blocking relation with whichever sector tooth **37** is next adjacent the pawl at the time of its energization.

A paper tape **46** is guided endwise through a guide channel **47** between a stationary platen **50** and an ink ribbon **51** (see also FIG. **3**), and is deflected upwardly by a concave guide surface formed on a tear-off member **49**.

Suitable line spacing means (not shown) is provided to push the paper **46** endwise through the channel **47** and past the platen **50** following each printing operation.

A combined aligning and printing bar **151** (see also FIG. **2**) extends through openings **31** in the sectors **11** and is guided for vertical movement, toward and away from the platen **50**, in guide slots **52** formed in the printer side frames, i.e. **14**.

Cam formations **53** are formed on the cam levers, i.e. **28**, and are arranged to engage the rod **151** after the various sectors **11** have been differentially arrested by their stop pawls **35** to cam rod **151** upwardly into centering engagement with detent notches **19** formed in the sectors **11**. Such notches are in radial alignment with respective ones of the type characters **18**. In centering the notches **19**, the rod **151** accurately aligns the type characters **20'** or **20** at the printing station **21**. Thereafter, the rod **151** flexes the type sections **16** outwardly, causing the selected type characters **20** to press upwardly against the printing ribbon **51**, paper tape **46** and platen **50** so as to transfer an imprint of such type characters onto the paper tape.

After the printing operation, the bail rod **30** is returned counterclockwise, engaging the sector shoulders **34** to likewise return the sectors to their illustrated home positions. During this time, the teeth **37** cam the stop pawls **35** to their illustrated retracted positions where they are retained by their friction tails **38**.

In accordance with the present invention, the type characters and stop teeth of certain of the sectors **11** are initially angularly offset or staggered relative to the type characters and stop teeth of the remaining sectors by an amount equal to one half the distance between two adjacent stop teeth. This is shown in FIG. **3** wherein two adjacent sectors **11*a*** and **11*b*** are depicted, both being in their initial positions with their shoulders **34** in engagement with the bail rod **30**. It will be noted that, although the pawls **35** are in alignment with each other, the teeth **37*a*** of sector **11*a*** are out of alignment with the teeth **37*b*** of sector **11*b*** and are preferably located midway between two adjacent ones of such latter teeth. Also, therefore, the type characters **20*a*** of sector **11*a*** are similarly located midway between adjacent type characters **20*b*** of sector **11*b***.

Timing means is provided to properly time transmission of data signals from a data source (not shown) and for controlling energization of the coils **40**. For this purpose, a light shutter **54** (FIGS. **2**, **4** and **5**) having a series of openings **55** therein is attached by screws **56** to a cam lever **28**. The screws **56** pass through arcuate slots **57** in a shutter **54**, permitting angular adjustment of the same. During a cycle of the machine, the shutter **54** passes between a lamp **60** and a photodiode **61**. The lamp **60** and photodiode **61** are mounted in a housing **62** supported by the base frame **15**, the lamp being effective to project a narrow beam of light across the path of the shutter and onto the photodiode.

Describing now the electronic control circuitry for the coils **40**, each coil is connected at one end to a source **611** of positive potential and at its opposite end, through a drive circuit **621** to a signal line **63**, over which timed positive going signal pulses are applied.

Each drive circuit **621** comprises a Darlington arrangement of two NPN transistors **65** and **66** as shown in FIG. **6**. A positive going signal applied to the base of transistor **65** will turn the latter on which, in turn, will turn on the transsitor **66** and therefore complete a circuit through the respective coil **40** to ground.

The photodiode **61** is connected in circuit with a resistor **67** between a source **68** of positive potential and ground.

The diode **61** is also connected to the base of an NPN transistor **70** which is connected between ground and a series of diodes **71** connected to alternate ones **63*b*** of the signal lines **63**. The collector of transistor **70** is connected to a source **72** of positive potential and to the base of a second NPN transistor **73**. The latter is connected between ground and a series of diodes **74** connected to intermediate ones **63*a*** of the signal lines **63**.

Normally, when the shutter **54** is in its illustrated position, the point **69** will be high and the transistor **70** will be biased on and transistor **73** will be biased off. Accordingly, diodes **71** will clamp the respective signal lines **63*b*** to low level potentials, preventing data signals from being transmitted through the associated drive circuits **63*b*** to the alternate coils **40*b*** associated with

the sectors **11***b*. At this time, diodes **74** have no effect on the intermediate signal lines **63***a* and, therefore, zero timed data signals can be applied to control one or more of the alternate coils **40***a* associated with sectors **11***a* to move the associated pawls **35** into the path of the first sector tooth or teeth **37***a* of the associated secor or sectors **11***a* and thus arrest such type sector or type sectors in position to print a zero character.

Timing of the data signals applied to the lines **63** is preferably also controlled by the shutter **54** and for this purpose timing signals are applied over line **79** to the data source (now shown).

It should be noted that each data signal extends over a time period sufficient for the pawls **35** to be moved to block the appropriate teeth **37***a* and **37***b* of the corresponding sectors, as will appear presently.

When the shutter **54** has moved clockwise an amount substantially equal to one half the pitch between two adjacent sector teeth **37**, it will cut off photodiode **61**, thereby turning diode **70** off and diode **73** on. Therefore, diodes **71** will unclamp the respective alternate signal lines **63***b* to enable energizing of the alternate coils **40***b* and diodes **74** will clamp the intermediate signal lines **63***a* to prevent energization of the alternate coils **40***a*. Accordingly, if data signals are applied at this time over any of the signal lines **63***b*, the corresponding sectors **11***b* will be arrested to position their zero type characters **20***a* at the printing station.

Accordingly, it will be seen that even if all zero characters were to be printed in a line across the printer, only one half of the type sectors **11** will be arrested at one point in time, the other half being arrested one half increment later. Thus, the "break-out load incurred by arresting the sectors **11** by their stop pawls **35** will be reduced by one half, enabling the use of a much smaller drive motor. On the other hand, in such case, since only half of the coils **40** would be energized at one point in time, a much smaller power supply for energizing such coils is necessary.

Since the staggered relation of the type characters and stop teeth of the sectors applies for all type characters, the same reduced mechanical and electrical loads will be obtained for any other values wherein a large number of similar characters are to be printed in the same print line.

The various type sectors **11** have been disclosed as alternately staggered, as shown particularly in FIG. **4**. However, they may also be arranged in other groupings. For example, the left hand group of sectors may be formed as depicted by sector **11***a* and the right hand group of sectors may be formed as depicted by sector **11***b*.

I claim:

**1.** A data printer comprising

a plurality of type devices having spaced type characters thereon,

each of said type devices having stop teeth thereon spaced to correspond with the spacing of said type characters;

yieldable drive means for advancing said devices from initial positions past a printing station,

stop pawl devices engageable with said teeth of respective ones of said type devices,

means for actuating said stop pawls at different times to engage different ones of said teeth whereby to present different ones of said type characters to said printing station, and

printing impression means for transferring an imprint on said type characters at said printing station to a record medium,

the type characters and stop teeth of a first series of said type devices being spaced at a single distance from said printing station and from their respective stop pawls, and

the type characters and stop teeth of a second series of said type devices being spaced at a single different distance from said printing station and from their respective stop pawls when all said type devices are in said initial positions.

**2.** A data printer comprising

a pluraliity of type members having spaced type characters thereon,

said type members having stop teeth thereon spaced the same as said type characters,

yieldable drive means for advancing said type members from initial positions past a printing station,

stop pawl devices engageable with said teeth of respective ones of said type members,

means for actuating said stop pawls at different times to engage different ones of said teeth whereby to present different ones of said type characters to said printing station, and

printing impression means for transferring an imprint from said type characters at said printing station to a record medium,

the stop teeth of a first series of said type members being spaced a single distance from their respective stop pawls, and

the teeth of a second series of said type members being spaced a single different distance from their respective stop pawls when said type members are in said initial positions.

**3.** A data printer as defined in claim **2** wherein the difference in spacing between a stop tooth on a type member of said first series and a corresponding stop tooth on a type member of said second series is less than the spacing between adjacent stop teeth on a type member of said first series.

**4.** A data printer as defined in claim **3** wherein said difference in spacing is one-half the spacing between said adjacent stop teeth on said type member of said first series.

**5.** A data printer comprising

a plurality of type devices having spaced type characters thereon,

each of said type devices having stop teeth thereon spaced to correspond with the spacing of said type characters;

yieldable drive means for advancing said devices from initial positions past a printing station,

stop pawl devices engageable with said teeth of respective ones of said type devices,

means for actuating said stop pawls at different time periods to engage different ones of said teeth whereby to present different ones of said type characters to said printing station, and

printing impression means for transferring an imprint from said type characters at said printing station to a record medium,

the stop teeth of a first series of said devices being spaced at a single distance from their respective stop pawls, and the stop teeth of a second series of said devices being spaced at a single different dis-

tance from their respective stop pawls when said type members are in said initial positions,

said actuating means actuating said stop pawls for said first series and said second series at different times within any one of said time periods.

6. A data printer as defined in claim 5 wherein said actuation of said stop pawls for said second series is delayed by an amount corresponding to the difference between the passage of a tooth of said first series past its respective stop pawl and the passage of a tooth of said second series past its respective stop pawl.

7. A data printer comprising

a plurality of type members having spaced type characters thereon,

said type members having stop teeth thereon spaced the same as said type characters,

yieldable drive means for advancing said members from initial positions past a printing station,

stop pawl devices engageable with said teeth of respective ones of said type members,

means for actuating said stop pawls at different time periods to engage different ones of said teeth whereby to present different ones of said type characters to said printing station,

printing impression means for transferring an imprint from said type characters at said printing station to a record medium,

the stop teeth of a first series of said type members being spaced apart the same distances as stop teeth of a second series of said type members and being staggered relative to said stop teeth of said second series by an amount equal to one-half the spacing between adjacent stop teeth of one of said type members when said type members are in said initial positions, and

said actuating means actuating said stop pawls of said second series later than actuation of said stop pawls of said first series by amounts corresponding to one-half the difference between passage of adjacent teeth of a said type member past its respective stop pawl.

* * * * *