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Le Gault et al.

[11] **3,734,010**

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[54] HIGH SPEED NUMBER PRINTER

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[52] **U.S. Cl.** **101/79**

[51] **Int. Cl.** **B41j 5/30**

[58] **Field of Search** 101/78, 79, 80, 75, 101/76, 72, 85, 84

[56] **References Cited**

UNITED STATES PATENTS

1,797,367	3/1931	Reinhardt	101/85
2,652,772	9/1953	Katz	101/85 X
3,107,606	10/1963	Baratelli	101/110 X
3,147,696	9/1964	Smith et al.	101/79
3,173,359	3/1965	Turner	101/79
3,420,163	1/1969	Ritzerfeld	101/76
3,603,251	9/1971	Elsworth	101/76

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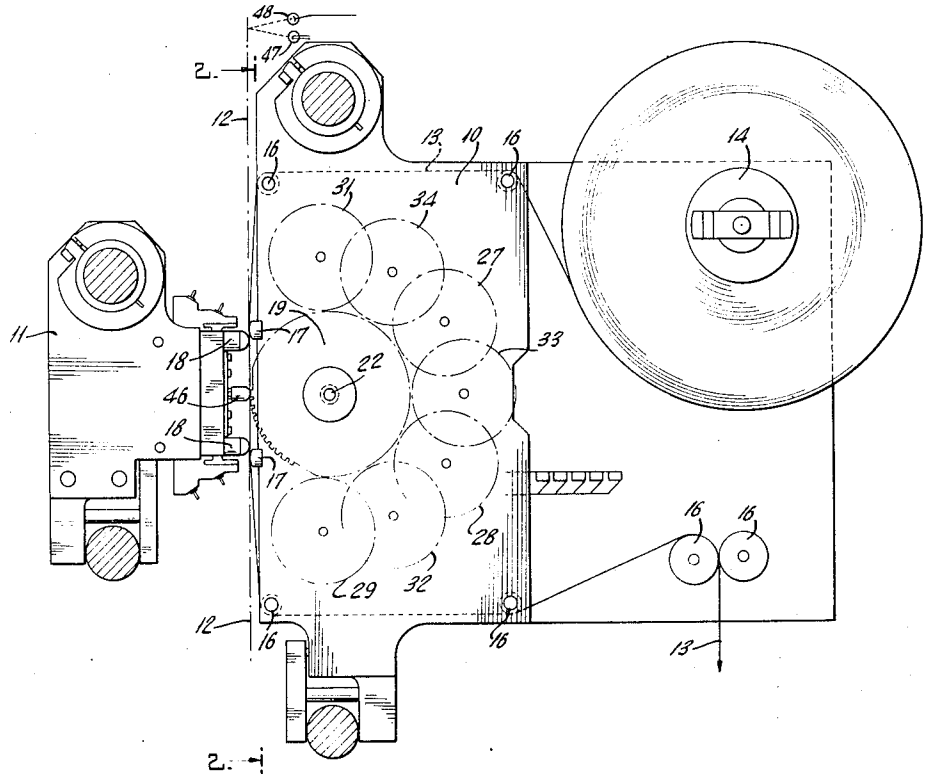
[57] **ABSTRACT**

A numbering station for a high speed printing machine is disclosed. The numbering station numbers a web moving through and being printed upon at other stations in the printing machine. At the numbering station a plurality of parallel numbering wheels, mounted on a common axis, are each individually positioned by a separate stepping motor in response to electric signals applied thereto. A ribbon passed between the numbering wheels and the moving web transfers ink to the web when a platen mounted in back of the web is periodically actuated.

The numbering wheels disclosed have numbers along a first sector of the periphery thereof and gear teeth along a second sector of the periphery thereof. The gear teeth are engaged by other gears each driven by one of the individual motors. Electrical signals are applied to the motors to move the numbering wheels to predetermined positions in response thereto. The numbers on the numbering wheels are arranged in an interlaced sequence to minimize the amount of travel necessary for consecutive numbering. A special stepping motor drive system is also disclosed which efficiently advances such numbering wheels.

24 Claims, 4 Drawing Figures



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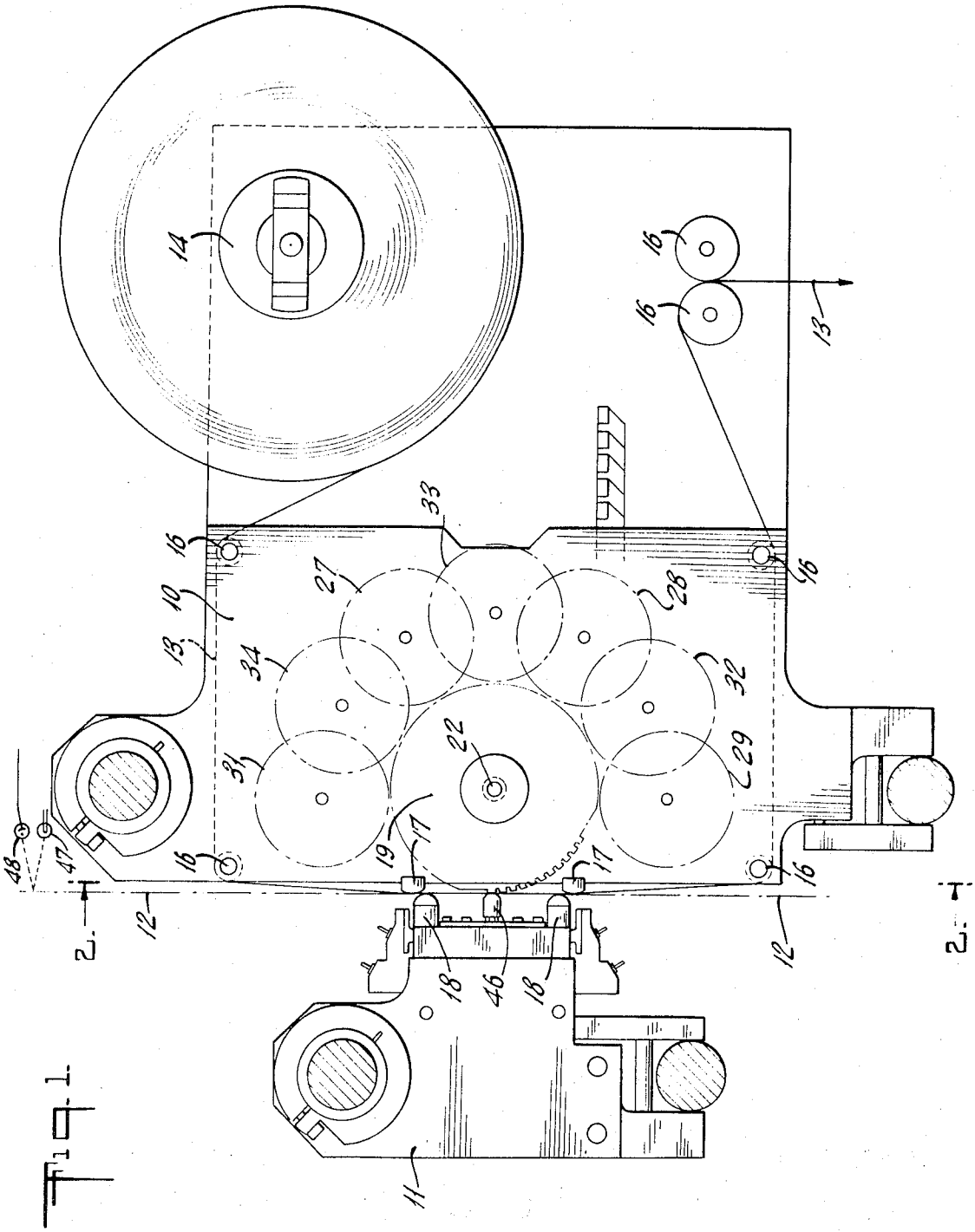

FIG. 1

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Fig. 2.

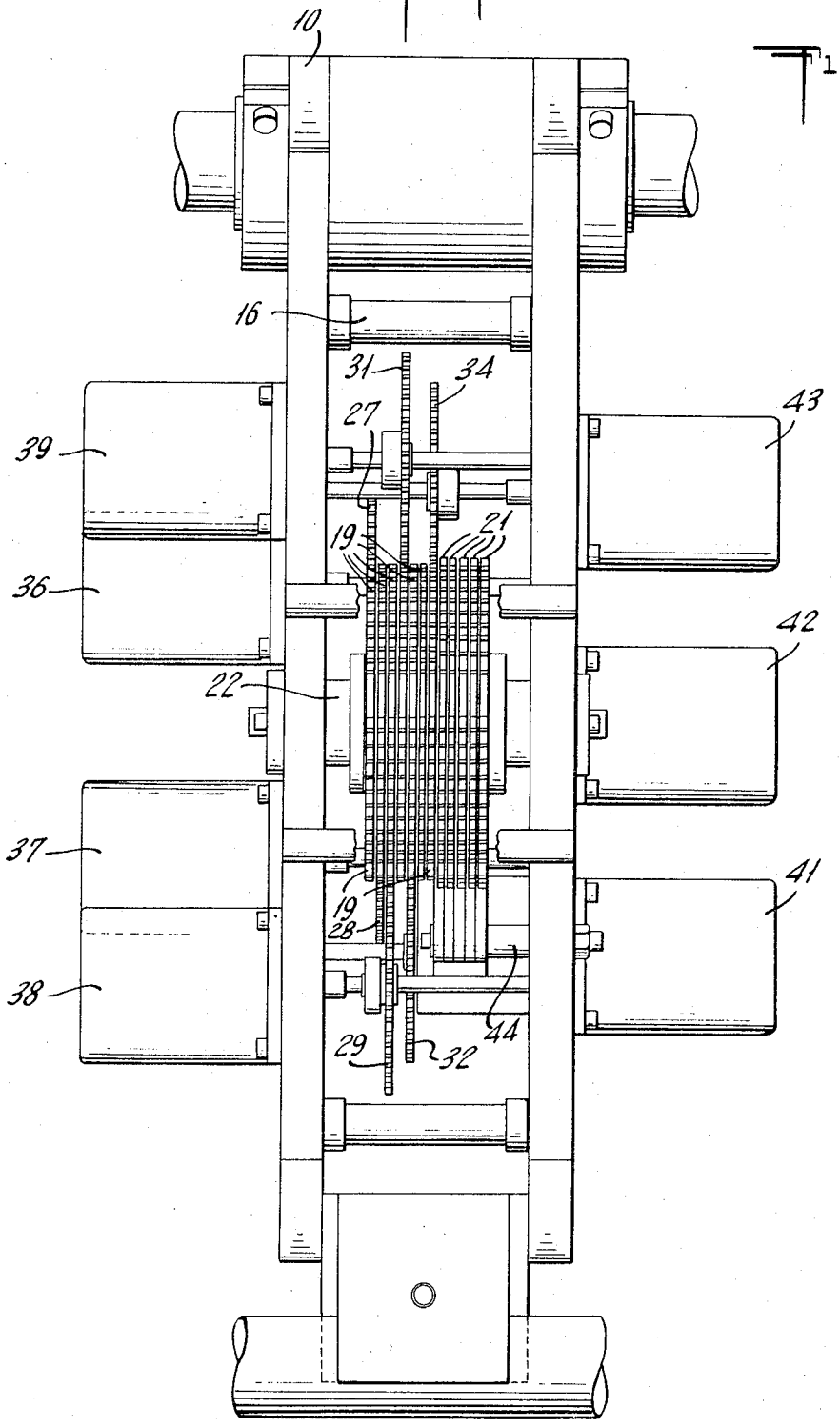

Fig. 3.

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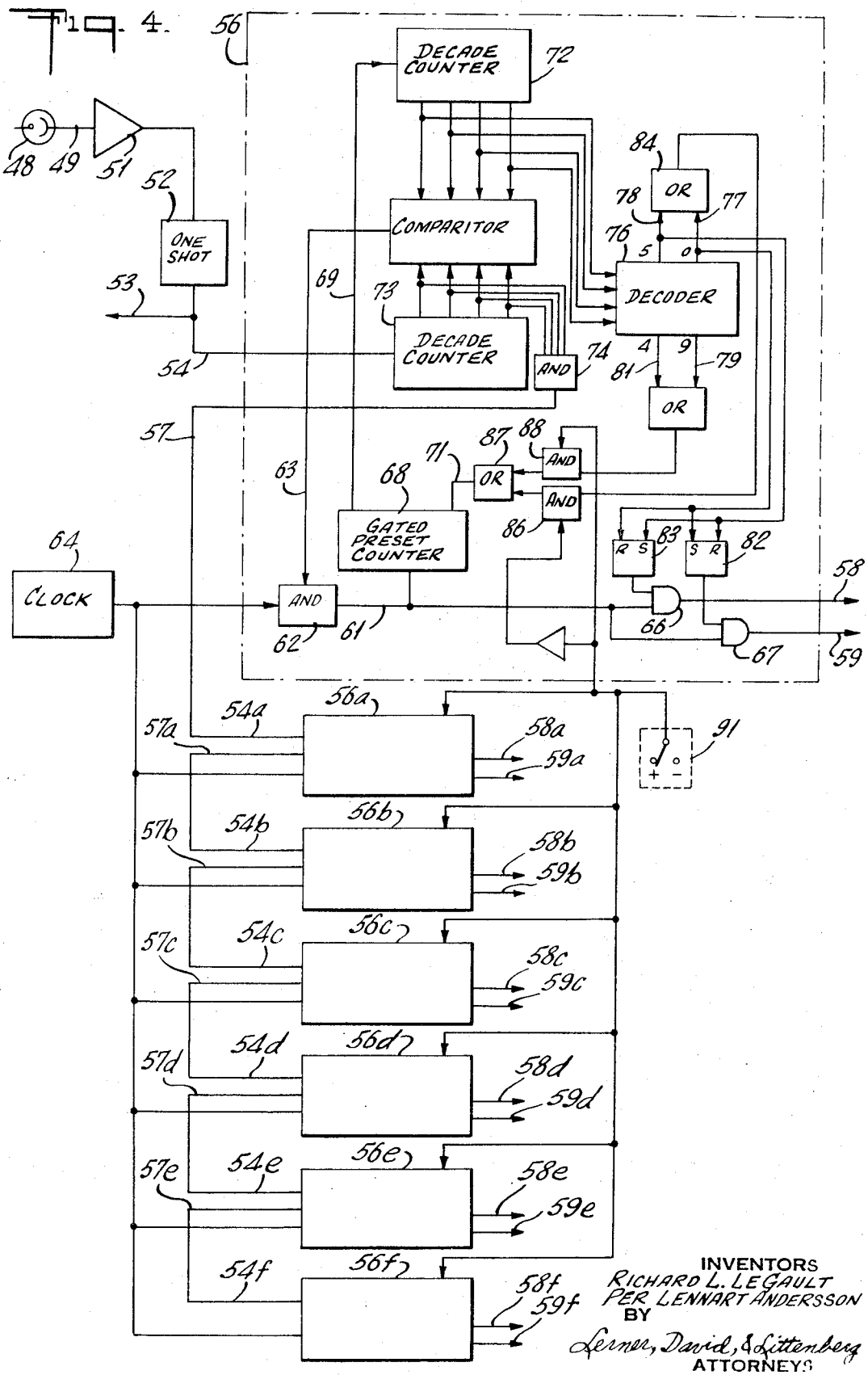
Fig. 4.



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HIGH SPEED NUMBER PRINTER

FIELD OF THE INVENTION

This invention relates to a numbering station for use with a printing press and particularly to a high speed electronically controlled numbering station for use in conjunction with a high speed printing press.

BACKGROUND OF THE INVENTION

Most high speed printing operations are performed on rotary printing presses in which a continuous web of paper is passed therethrough at a high speed. Impressions are made on the web by rotating drums having inked impressions thereon. The drums are rotated in synchronism with each other and the motion of the paper so that multiple and overlayed impressions can be made on the web.

High speed printing presses may also have additional stations associated therewith. Such stations may perform perforation punching or cutting operations. The key to present high speed printing is the repetitiveness of tasks performed at each station. Printing by its very nature implies repetition.

In many types of printing operations a select portion of the material being printed must be altered from impression to impression. For example, when printing a numbered business form, the bulk of the form is constant from impression to impression but the number thereon must be altered for each impression. The equipment which operates to print the portion of the text which changes from impression to impression is known in the trade as numbering equipment. This is true even if the portion of the text which changes does not contain numbers therein but rather some other form of symbols.

Typically a numbered business form is printed on a multiple station printing press in which the fixed portions thereof are printed at a first station and the changed portions thereof are printed at a second or numbering station. The most commonly used numbering stations in multiple station printing presses includes a plurality of conventional numbering heads mounted circumferentially around a printing wheel for rotary printing on the web. Such a system is shown in U.S. Pat. No. 2,825,279 which issued to I.S. Gottscho on Mar. 4, 1958 and entitled "Marking and Numbering Means for Strip Material".

The reason the plurality of numbering heads are mounted circumferentially around the printing wheel is to obtain higher speeds. The time necessary to physically advance numbering heads from number to number is too slow to be compatible with high speed printing. Even with this type of arrangement the speed of printing, where numbering is required, is limited by the speed of operation of the numbering station.

In some situations it has been found economically more advantageous to run a printing press at its maximum speed and not perform the numbering operation thereon. After the normal printing operations are completed the web upon which the printing has occurred is then registered and run on a slower numbering machine. This type of system has been found, in some instances, to be more economical than slowing down the high speed printing press. It would be more desirable, however, if ultimately a numbering station could be provided which ran at speeds comparable to the high speed printing press.

A high speed computer printout could be looked to when designing structures for high speed numbering stations. The systems most commonly employed in computer printouts involve the intermittent stopping of the continuous web with a portion to be printed on adjacent to a printing position. A printing cylinder having a full line of each number or letter in a set thereon is intermittently rotated with each line dwelling during a printing interval at the printing position while the portion of the web to be printed on rests adjacent to the printing position. A platen is struck adjacent to the particular digit or line position where the number or letter on the stopped line is to be imprinted. After complete rotation of the numbering disc, the desired number or message is printed on the web.

This system would be too slow for high speed numbering since the web must be stopped and struck once for each number or letter in a particular system being used. Further, it is incompatible with high speed printing machines because if the web coming from a rotary printing station must be stopped at the numbering station, stresses and strains will develop upon the paper which might well rip the paper.

Therefore, it is an object of this invention to provide a new and improved numbering station for a high speed printing machine.

It is a further object of this invention to provide a numbering station for a high speed printing machine which is faster than presently available numbering stations.

It is still another object of this invention to provide a numbering station for a high speed printing machine which does not alter the mode of advancing a web fed through the printing press.

BRIEF DESCRIPTION OF THE INVENTION

With these and other objects in view, the present invention contemplates a system in which a web which is to be printed upon is continuously moved along a first path and a ribbon is moved along a second path. The second path is adjacent to the first path at a numbering position. A plurality of numbering wheels are mounted on a first side of the paths adjacent to the numbering positions while a hammer is mounted on a second side of the paths adjacent to the numbering position. Each of the numbering wheels are independently set to predetermined positions by electric signals in response to a printing signal which actuates the hammering to impel the web and ribbon against its plurality of numbering wheels imprinting appropriate symbols on the web. The inertia of the motors and wheels prevent the wheels from moving to their new positions before the imprinting operation is complete. In the preferred embodiment the numbering wheels have symbols on a first segment thereof and gearing surfaces on a second segment thereof.

To facilitate consecutive numbering the symbols are interlaced to minimize the amount of travel necessary. The stepping motor drive circuitry is specifically configured to efficiently drive such interlaced numbering wheels in both a forward and reverse numbering mode.

External signals can be applied to the circuitry of this invention to preset the numbering wheels to an initial number. If a desired sequence is required, such as modular systems **7, 9, 10** and **11**, external signals can be applied for each number to be printed by special sequence generating circuitry.

DESCRIPTION OF THE DRAWINGS

A more complete understanding of the invention can be had by reference to the following detailed description and drawings in which:

FIG. 1 is a side view of a high speed numbering station constructed in accordance with the teachings of this invention;

FIG. 2 is a section view taken along the lines 2—2 of FIG. 1 and shows the arrangement of stepping motors, gears and numbering wheels in the high speed numbering station of FIG. 1;

FIG. 3 is a front view of a numbering wheel employed in the numbering station of FIG. 1 and particularly showing the interlaced relationship of numbers on the numbering wheel; and

FIG. 4 is a block diagram showing a system for controlling the position of the numbering wheels of FIG. 3.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIG. 1 we see a high speed numbering station for a multi-station printing press, not shown, constructed in accordance with the principles of this invention. The numbering station includes a numbering wheel carrying assembly 10 and a hammer carrying assembly 11 mounted adjacent to the numbering wheel carrying assembly 10. The relationship between the numbering wheel carrying assembly 10 and the hammer assembly 11 defines a first path of travel for a continuous web of paper 12 as it moves from a prior station, not shown, to a subsequent station, not shown. An inked ribbon 13 supplied from a roll 14 mounted on the numbering wheel carrying assembly 10 is guided by rollers 16 along a second path. The portions of first and second paths which are between the numbering wheel carrying assembly 10 and the hammer carrying assembly 11 run adjacent to one another. The physical relationship between the moving paper 12 and ribbon 13 is maintained along the portion of the paths by a pair of carbide rubbing blocks 17 mounted on the left hand portion of the numbering wheel carrying assembly 10. Each block 17 has a depression therein approximately to thousandths of an inch deep for guiding the ribbon 13 and a top guiding surface for carrying the paper 12. A second pair of carbide rubbing blocks 18 mounted on the hammer carrying assembly 11 hold the paper against the top guiding surface at the blocks 17.

Seven motor driven numbering wheels 19 and five hand adjustable numbering wheels 21 (see FIG. 2) are mounted for rotation on an axle 22 which is anchored in the walls of the numbering wheel carrying assembly 10. Each of the numbering wheels 19 and 21 (see FIG. 3) has a plurality of symbols along a first portion 23 of the periphery 24 thereof and gear teeth along a second portion 26 of the periphery 24. The symbols are placed along a small portion of the periphery to reduce the time which may be required for positioning.

The symbols, in this example, form a sequence from zero to nine arranged in two series. One series runs from zero to four and the second runs from five to nine. Each series runs in an opposite direction along the periphery 24 of the numbering wheel 19 in an interspersed fashion so that adjacent symbols in the sequence have twice the intersymbol spacing therebetween except at the end of the series. For example, the four and the five are adjacent in the sequence but in different series and therefore have only one symbol spacing therebetween. The zero and the nine are similar. It should be noted that an additional symbol (x) is placed adjacent to the zero but does not fall in the sequence.

Each of the motor driven numbering wheels 19 are engaged by a gear 27 through 29, 31 through 34. Each of the gears 27 through 29, and 31 through 34 are driven by an individual stepping motor 36 through 39, and 41 through 43 respectively. It should be noted that the motors are mounted in an arcuate array around the axle 22 with alternate adjacent gears along the arc such as gears 31 and 34 being driven by motors 39 and 43 on opposite sides of the numbering wheel carrying assembly 11. This arrangement enables the physical connection of seven closely spaced numbering wheels to be each driven by an independently controlled stepping motor. The five hand controlled numbering wheels 21 are adjusted manually by manual type setting generally designated 44.

In operation a number is printed upon the web 12 when the hammer 46 (see FIG. 1) impels the paper 12 and the ribbon 13 against the face of the numbering wheels 19 and 21 thereby transfering ink from the ribbon 13 to the paper 12. imprinting the symbols provided by the numbering wheels 19 and 21. The imprinting occurs while the web of paper 12 and the ribbon 13 are moving at their normal linear speeds (driven by means not shown) through the numbering station. The numbering wheels 19 and 21 are stationary during the imprinting process. This is different than the imprinting which occurs at the other stations in the multiple station printing press at which the printing surfaces are on rotary drums to compensate for the movement of the paper.

The web of paper 12 may, in some instances, have marking along a margin thereof to indicate where a number should be imprinted. In such a situation a light photocell combination can be employed to actuate the hammers 46. In FIG. 1, we see a light 47 and a photocell 48 (shown schematically) mounted on the numbering wheel carrying assembly 10 to provide a pulsed control signal each time a marking on the web paper 12 passes thereby. The speed of the web paper 12 and the spacing between the light photocell combination and the printing position (defined by the numbering wheels 19 and 21 and the hammers 46) determines how far from the place where the number is to be imprinted, the markings in the margins must be placed. It should be remembered, of course, that the hammers 46 have a mechanical inertia so that a time interval will elapse between the application of the control signal to the hammers 46 and the actual imprints.

When numbering is done at the numbering station of this invention, the numbering wheels 19 must be positioned for the next imprinting on the web 12 before the next marking passes the light photocell combination but still must not move significantly before the imprinting has occurred. To this end, the same control signal supplied by the light photocell combination which actuates the hammers 46 also actuates the numbering wheels 19 through the gears and stepping motors to advance to the next number. The mechanical inertia of the hammers 46 and the numbering wheel setting chain is such that the printing is completed before substantial movement of the numbering wheel occurs.

Referring now to FIG. 4 we see the circuitry which enables the printing station of this invention to func-

tion. The photocell 48 provides a pulse on an output lead 49 each time the markings in the margins on the web paper 12 passes thereby. The pulse is amplified by an amplifier 51 and shaped in a one shot multi-vibrator circuit 52. The one shot multi-vibrator circuit 52 cleans up the pulse provided by the amplifier 51 and provides sufficient power to drive the hammers 46 in the hammer assembly 11. A lead 53 is provided to send the pulse to drive the hammers 46. It should be appreciated, of course, that additional amplification and shaping can be interposed between the one shot 52 and the hammers 46. Also, additional circuitry can be supplied to inhibit individual hammers until a nonzero number is present on a particular wheel to correspond to what is normally known as drop cypher numbering.

The output from the one shot 52 is also applied by a lead 54 to a first number wheel setting circuit 56. The number wheel setting circuit 56 has three output leads. One output lead is designated 57 and drives a next number wheel setting circuit 56*a* while a pair of output leads 58 and 59 drive the stepping motor 56 in a forward and reverse direction respectively. Each of the additional number wheel setting circuits 56*b* through 56*f* are all identical with each other and with the circuits 56 and 56*a*. Each circuit 56 and 56*a* through 56*f* drives one stepping motor and, therefore one numbering wheel 19.

Looking now, particularly at the number wheel setting circuitry 56, we see that a pulse train is provided on a lead 61 when an "and" gate 62 is enabled by a signal on a lead 63 to pass therethrough pulses continuously supplied by a clock circuit 64. The pulses on the lead 61 are passed by either an "and" gate 66 or 67 to either of the output leads 58 or 59 respectively. In this particular embodiment there are five gear teeth on the numbering wheel 19 for each distance equivalent to the inter-symbol spacing on the portion 23 thereof. Therefore, ten pulses must be provided on the lead 58 to move the numbering wheel 19 one symbol in the forward direction while five pulses must be provided on the lead 59 to move the numbering wheel 19 one symbol in a reverse direction.

The pulse train on the lead 61 is also applied to a gated preset counter 68 which normally provides an output signal on a lead 69 when ten pulses have been applied to the input thereof by the lead 61. When, however, a signal is applied at an input by the lead 71, a signal will be provided on the lead 69 in response to five pulses at the input lead 61. The lead 61 applies the pulses thereon to a decade counter 72 while the control signal supplied from the photocell through the amplifier 51 and one shot 52 is applied to a second decade counter 73.

The output from the decade counters 72 and 73 are compared by a comparitor which drives the lead 63. When the numbers stored in the decade counters 72 and 73 are identical a first signal is applied on the lead 63. When the numbers stored in the decade counters 72 and 73 are different, a second signal is provided on the lead 63. When the second signal is present on the lead 63, the "and" gate 62 passes the pulses from the clock 64 to the lead 61 thereby advancing the decade counter 72 when either five or ten pulses have been provided to bring the decade counter 72 into line with the decade counter 73. At the same time, these pulses are also applied to either the forward or reverse leads 58 or 59, respectively, driving the respective stepping motor.

A decoder circuit 74 decodes the output of the decade counter 73 to provide a signal when a predetermined number, for example zero, occurs so that each recycling of the decade counter 73 will provide a pulse signal to the lead 57 which is employed as an input to the next number wheel positioning circuit 56*a*. In this way, it is seen that with the arrangement as shown the decade counter 73 is advanced one number for each marking on the web of paper 12 while the circuit 56*a* is advanced for each ten markings, 56*b*, each hundred markings and so on. It is also clear that for each advance of the decade counter 73, either five or ten pulses are applied to the respective stepping motor to drive it in either the forward or reverse direction. As these pulses are applied to the stepping motor, the numbering wheel 19 is advanced in an orderly sequence.

It should be clear also that if one wished to advance the numbering wheels 19 in a random or other than orderly sequence, one would merely inject desired numbers into the decade counters 73 and allow the remaining circuitry to drive the decade counter 72 to track it. As we shall see, the remaining circuitry in the positioning circuit 56 will bring the numbering wheel to the appropriate position.

The output of the decade counter 72 is passed through a decoder 76 to provide an output signal on a lead 77, 78, 79 and 81 when the numbers 0, 5, 9 and 4 are respectively decoded. The 0 and 5 are applied to set and reset a pair of flip-flops 82 and 83, respectively. The flip-flops 82 and 83 drive the "and" gates 66 and 67. In this way, the the direction in which the stepping motors are driven are reversed each time the numbers 0 and 5 occur which are the end points of the numbering wheel 19.

The leads 77 and 78 are also employed to apply the 0 and 5 signals to an "or" gate 84 which drives an "and" gate 86. The output from the "and" gate 86 is applied to an "or" gate 87 which drives the lead 71. Therefore, each time the "and" gate 86 is enabled and a 0 or 5 are decoded from the decade counter 72, the gated preset counter 68 provides an output pulse on the lead 69 for five input pulses on the lead 61 rather than ten. In this way, it is seen looking at FIG. 3 that the numbering wheel 19 will be advanced starting with 0 to 9, then 8, then 7, then 6 and then 5. At 5, the direction of the motor will be reversed and the gated preset counter 68 will provide an output signal for only five pulses so that the next step will be to 4, then 3, then 2, then 1 and then 0. At 0 the motor will again be reversed and the gated preset counter conditioned to provide an output for five pulses rather than ten to go to nine.

In this way, it is seen that each time the "and" gate 86 is energized the stepping motor will drive the numbering wheel 19 in a reversed sequence. On the other hand, when an "and" gate 88 is enabled the gated preset counter 68 will count five rather than ten for the numbers 4 and 9 so that again looking at FIG. 3 we see that starting at 0 the wheel would be advanced two spaces to 1, then 2, then 3 and then 4. At 4 the gated preset counter 68 will move us five steps, one inter-symbol spacing to 5; at 5 the direction of the motor will be reversed and therefrom go to 6, 7, 8 and 9. At 9 the gated preset counter 68 will count five steps advancing to 0 and at which point the motor will again be re-

versed. Therefore, it is seen through the circuitry provided that either a positive or negative sequence can be advanced depending upon which of the "and" gates **86** or **88** are enabled. To this end an inverter **89** is provided to drive the "and" gates **86** and **88** so that only one is enabled at one time. The inverter **89** is driven by a switch **91** which determines if the numbering wheels are to advance in a forward or reverse sequence.

It should be clear from the above that the circuitry taken together with the structures shown in FIGS. **1** and **2** will advance in a positive or negative sequence, one number at a time, each time a marking on the web **12** passes the light photocell combination.

It should be clear, however, that other ways can be employed for synchronizing the position where the numbering is to be done and also that the above system, quite differently from most existing numbering systems, can be randomly positioned in response to external electronic signals applied to the decade counter **73** in each of the circuits **56.**

It should also be understood that while this invention has been described with respect to a particular embodiment thereof, numerous other embodiments will become obvious to those of ordinary skill in the art in light thereof.

What is claimed is:

1. A machine for successively placing symbols at predetermined places on a web as said web moves along a path said machine including:

a first numbering wheel having a plurality of distinct symbols distributed along a periphery thereof; said first numbering wheel being mounted in said machine on a first side of said path, with one of said plurality of distinct symbols on said periphery thereof adjacent to said path;

a second numbering wheel having a plurality of distinct symbols distributed along the periphery thereof; said second numbering wheel being mounted in said machine adjacent to said first numbering wheel on said first side of said path, with one of said plurality of distinct symbols on said periphery thereof adjacent to said path;

means responsive to a control signal, mounted in said machine on a second side of said path, for impelling said web against one of said symbols on said periphery of said first and second numbering wheels adjacent to said path;

first means rendered effective by said control signal responsive to a first number signal for positioning a predetermined one of said plurality of symbols on said periphery of said first numbering wheel adjacent to said path; and

second means rendered effective by said control signal responsive to a second number signal for positioning a predetermined one of said plurality of symbols on said periphery of said second numbering wheel adjacent to said path.

2. The machine as defined in claim **1** in which said first numbering wheel positioning means includes:

means responsive to a first gate signal for generating a first pulse train to advance said first numbering wheel a fixed angular increment for each pulse in said first pulse train.

a first accumulator for accumulating occurrences of said control signal to provide a first accumulator output signal;

a second accumulator for accumulating pulses in said first pulse train to provide a second accumulator output signal; and

means responsive to a difference between said first and second accumulator output signals for providing said first gate signal.

3. The machine as defined in claim **2** in which said first accumulator output signal will increase a first predetermined amount in response to one occurrence of said control signal while said second accumulator output signal will increase said first predetermined amount in response to a first plurality of pulses in said first pulse train.

4. The machine as defined in claim **3** in which said first and second accumulator output signals will advance from a first value to a second value and then recycle back to said first value.

5. The machine as defined in claim **4** in which said second numbering wheel positioning means includes:

means responsive to a second gate signal for generating a second pulse train to advance said second numbering wheel a fixed angular increment for each pulse in said second pulse train;

a third accumulator for accumulating cycles of said first accumulator to provide a third accumulator output signal;

a fourth accumulator for accumulating pulses in said second pulse train to provide a fourth accumulator output signal; and

means responsive to a difference between said third and fourth accumulator output signals for providing said second gate signal.

6. The machine as defined in claim **5** in which said third accumulator output signals will increase a second predetermined amount in response to one cycle of said first accumulator while said second and fourth accumulator output signal will increase said second predetermined amount in response to a second plurality of pulses in said second pulse train.

7. The machine as defined in claim **6** in which said first and second accumulator output signals will advance from said first value to said second value and the result to said first value.

8. The machine as defined in claim **7** in which said first plurality is equal to said second plurality.

9. The machine as defined in claim **1** in which said control signal increments said first number signal and said first number signal increments said second number signal.

10. A machine as defined in claim **1** in which said web has markings thereon to indicate where said symbols are to be placed; said machine also including:

means responsive to said markings on said web passing a predetermined place on said path for generating said control signal.

11. The machine as defined in claim **10** in which said control signal generating means includes:

a light source mounted on said machine to shine on said web; and

a photocell mounted on said machine to detect light reflected from said web to provide said first control signal.

12. The machine as defined in claim **10** in which said first numbering wheel positioning means includes:

means responsive to a first gate signal for generating a first pulse train to advance said first numbering

wheel a fixed angular increment for each pulse in said first pulse train.

13. The machine as defined in claim **12** in which said first accumulator output signal will increase a first predetermined amount in response to one occurrence of said control signal while said second accumulator output signal will increase said first predetermined amount in response to a first plurality of pulses in said first pulse train.

14. The machine as defined in claim **1** in which:

said distinct symbols along said periphery of said first numbering wheel form a sequence with physically adjacent symbols having a predetermined spacing therebetween; said symbols being arranged along said periphery of said first numbering wheel in two interspersed series wherein the sequence proceeds in opposite directions in the two series so that sequentially adjacent symbols within each series are physically separated by twice said predetermined spacing while sequentially adjacent symbols which fall one in each series are physically separated by said predetermined spacing; and

said first positioning means includes:

means responsive to the position of said numbering wheel for providing a first position signal when a symbol is adjacent to said path which is in the same series as the next symbol in the sequence and a second position signal when a symbol is adjacent to said path which is not in the same series as the next symbol in the sequence; and

means rendered effective by said control signal responsive to said first position signal for moving said first numbering wheel twice said predetermined spacing with respect to said path; said first moving means being further responsive to said second position signal for moving said first numbering wheel said predetermined spacing with respect to said path.

15. A machine as defined in claim **14** in which said first positioning means also includes:

means responsive to a first gate signal for generating a first pulse train to advance said first numbering wheel a fixed angular increment for each pulse in said first pulse train;

a first accumulator for accumulating occurrences of said control signal to provide a first accumulator output signal;

a second accumulator for accumulating pulses in said first pulse train to provide a second accumulator output signal; and

means responsive to a difference between said first and second accumulator output signals for providing said first gate signal.

16. The machine as defined in claim **15** in which said first accumulator output signal will increase a first predetermined amount in response to one occurrence of said control signal while said second accumulator output signal will increase said first predetermined amount in response to a first plurality of pulses in said first pulse train.

17. In combination:

means for defining a first path along which a web is continuously advanced;

means for defining a second path along which a printed ribbon is advanced; said second path being adjacent to said first path at a numbering position thereof;

a plurality of numbering wheels mounted on a first side of said paths adjacent to said numbering position; said numbering wheels each being independently settable to predetermined positions;

means mounted on a second side of said paths adjacent to said numbering position of said paths for impelling said web and said ribbon against said plurality of numbering wheels;

said numbering wheels have a sequence of symbols arranged thereon with physically adjacent symbols having a predetermined spacing therebetween; said symbols being arranged in two interspersed series wherein the sequence proceeds in opposite directions in the two series so that sequentially adjacent symbols within each series are physically separated by twice said predetermined spacing while sequentially adjacent symbols which fall one in each series are physically separated by said predetermined spacing; and

each of said plurality of numbering wheels are positioned by:

means responsive to the position of said numbering wheel for providing a first position signal when a symbol is at said predetermined position which is not in the same series as the next symbol in the sequence; and

means rendered effective by a control signal responsive to said first position signal for moving said numbering wheel twice said predetermined spacing with respect to said predetermined position; said moving means being further responsive to said second position signal for moving said numbering wheel said predetermined spacing with respect to said predetermined position.

18. The combination as defined in claim **17** in which said web has markings thereon to indicate where said symbols are to be placed, said combination also including:

means responsive to said markings on said web passing a predetermined place on said path for generating said control signal.

19. The combination as defined in claim **18** in which said control signal is employed for actuating said impelling means.

20. In combination:

a numbering wheel having a sequence of symbols arranged thereon with physically adjacent symbols having a predetermined spacing therebetween; said symbols being arranged in two interspersed series wherein the sequence proceeds in opposite directions in the two series so that sequentially adjacent symbols within each series are physically separated by twice said predetermined spacing while sequentially adjacent symbols which fall one in each series are physically separated by said predetermined spacing;

means for movably mounting said numbering wheel so that each of said symbols may be individually positioned adjacent to a predetermined point; and

means for positioning said numbering wheel; said positioning means including:

means responsive to the position of said numbering wheel for providing a first position signal when a symbol is adjacent to said predetermined point which is in the same series as the next symbol in the sequence and a second position signal when a symbol is adjacent to said predetermined point which

is not in the same series as the next symbol in the sequence; and

means rendered effective by a control signal responsive to said first position signal for moving said numbering wheel twice said predetermined spacing with respect to said predetermined point; said moving means being further responsive to said second position signal for moving said numbering wheel said predetermined spacing with respect to said predetermined point.

21. The combination as defined in claim **20** in which said positioning means is further responsive to said first position signal for advancing said numbering wheel in a first direction and further responsive to said second position signal for advancing said numbering wheel in a second direction.

22. The combination as defined in claim **21** in which said positioning means further includes:

means responsive to a first gate signal for generating a first pulse train to advance said first numbering wheel a fixed angular increment for each pulse in said first pulse train;

a first accumulator for accumulating occurrences of said control signal to provide a first accumulator output signal;

a second accumulator for accumulating pulses in said first pulse train to provide a second accumulator output signal; and

means responsive to a difference between said first and second accumulator output signals for providing said first gate signal.

23. The combination as defined in claim **20** in which said positioning means also includes means responsive to the position of said numbering wheel for providing a third position signal when a symbol is adjacent to said predetermined point which is in the same series as the preceding symbol in the sequence and a fourth position signal when a symbol is adjacent to said predetermined point which is not in the same series as the preceding symbol in the sequence; and

means for rendering said moving means responsive to said third and fourth position signals and nonresponsive to said first and second position signals respectively.

24. The combination as defined in claim **23** in which said positioning means is further responsive to said first position signal for advancing said numbering wheel in a first direction and further responsive to said second position signal for advancing said numbering wheel in a second direction.

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