United States Patent [19]

Pfaffle

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[54] WEB PRINTING MEANS

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[21] Appl. No.: **108,482**

[52] **U.S. Cl.** **118/212,** 74/393, 74/435, 101/228, 118/222, 118/224

[51] **Int. Cl.** **B05c 1/08,** F16h 35/02

[58] **Field of Search**.....101/219, 224, 225, 227, 228; 74/393, 435; 270/21; 118/211, 212, 216, 221, 222

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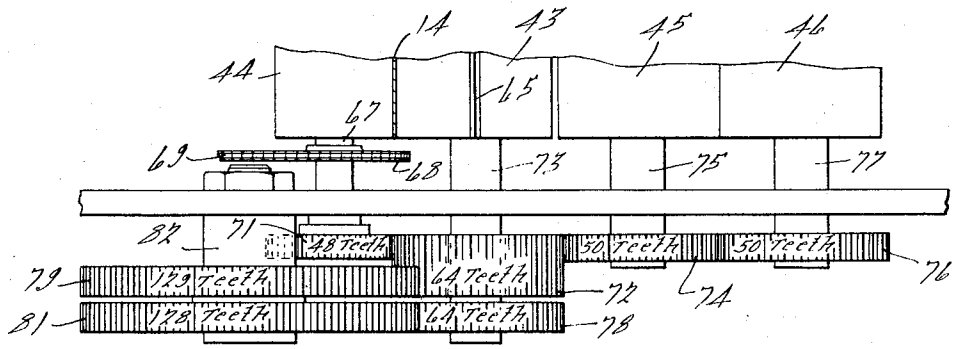
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[57] **ABSTRACT**

Means for printing margin lines on a web of ruled paper to be cut into multiple-leaved sheets, in which a trim allowance is to be provided at the ends of each sheet. The means comprises a margin line printing roll having a plurality of equidistantly spaced ridges. The roll is driven by a gear the teeth of which have a predetermined pitch, except for one section in which there is a larger pitch. The margin lines will be printed at even intervals during the time the roll is driven by the teeth of predetermined pitch, but with the paper moving at a constant speed, a slightly greater interval will occur between margin lines during the time the roll is driven by the tooth section of larger pitch. Thus, the web may later be cut to form sheets each of which has a trim allowance at the outer edges thereof. The sheet is later cut into individual leaves.

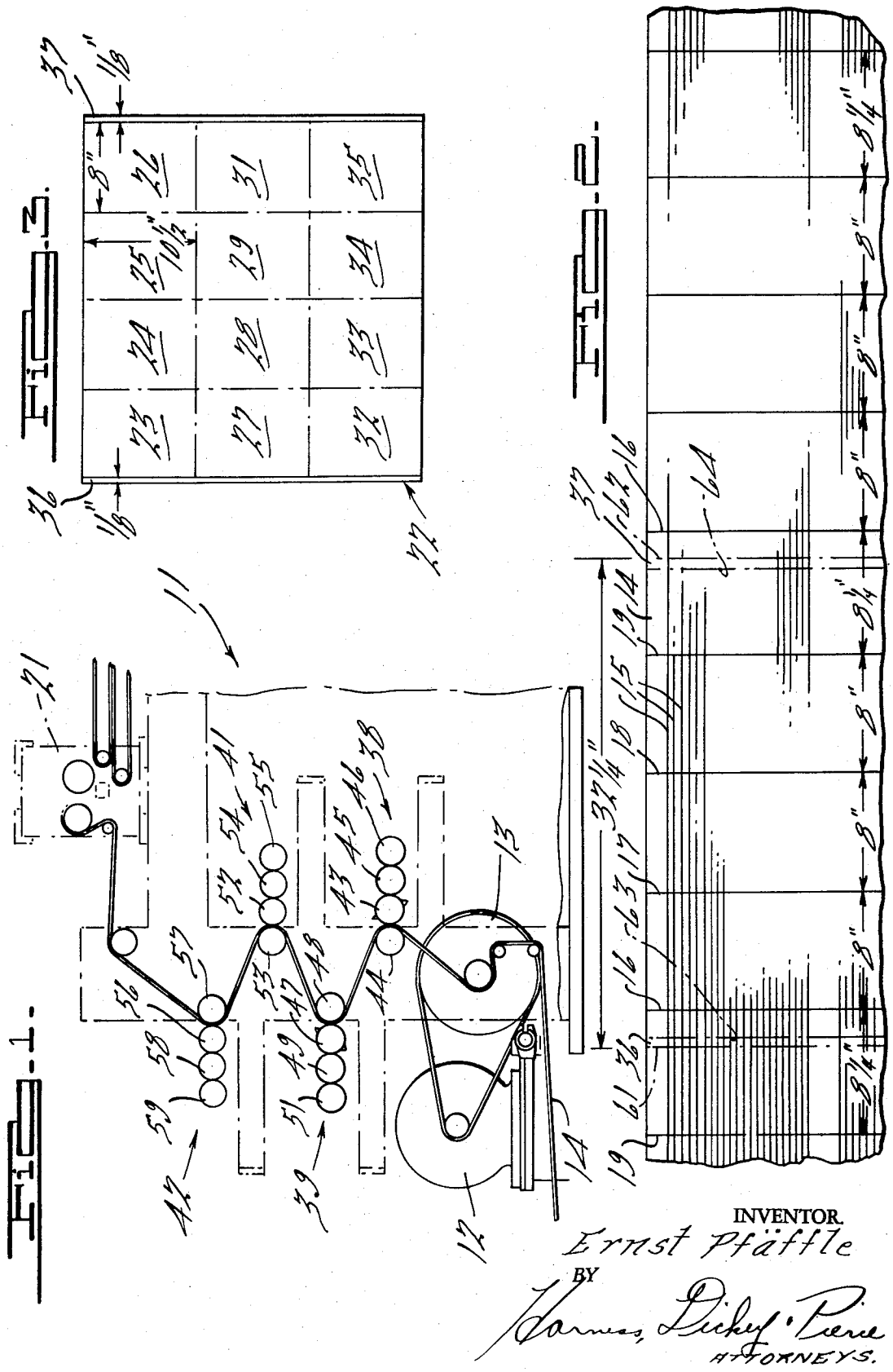
7 Claims, 7 Drawing Figures



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SHEET 1 OF 3



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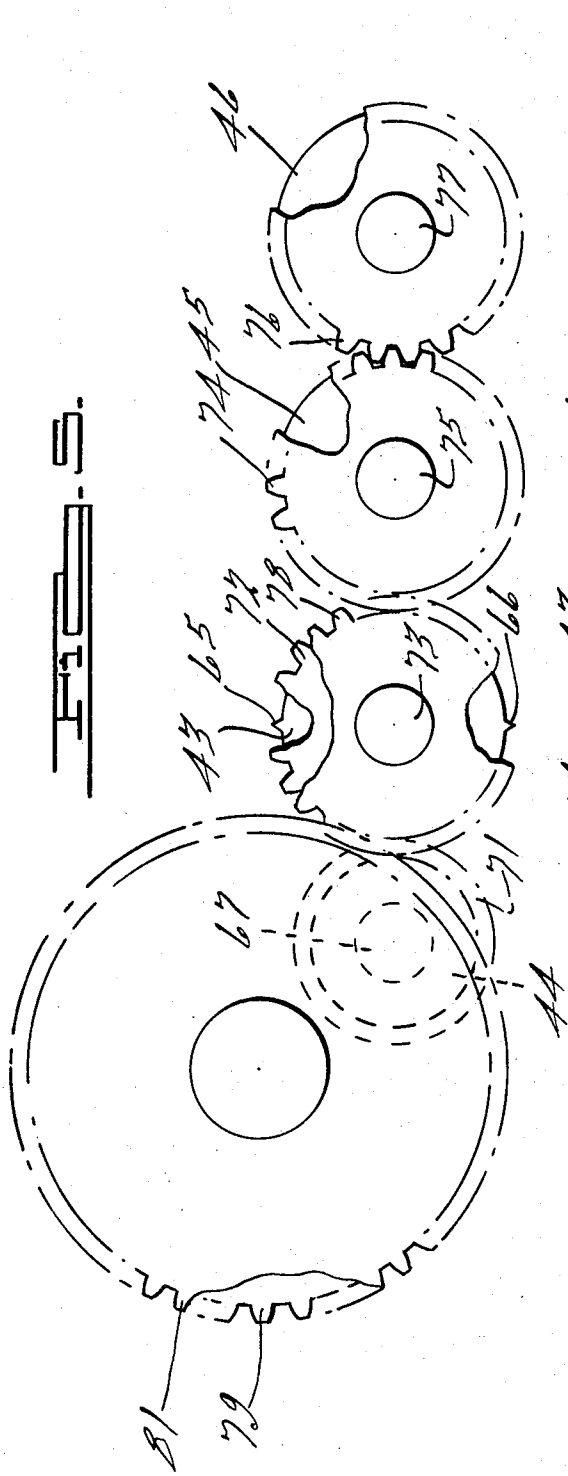


FIG. 5.

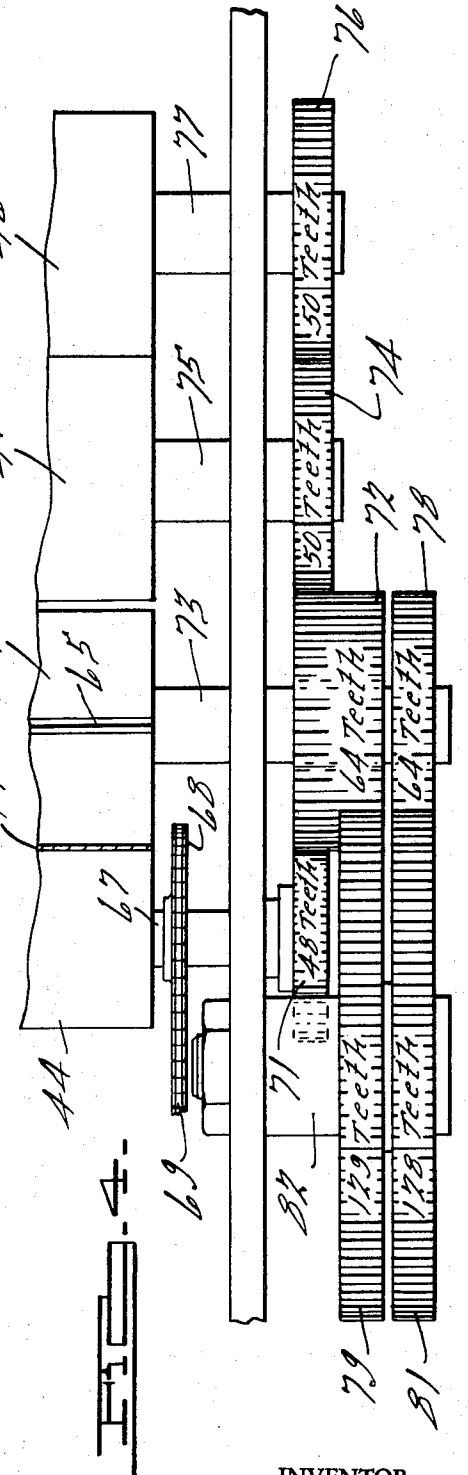
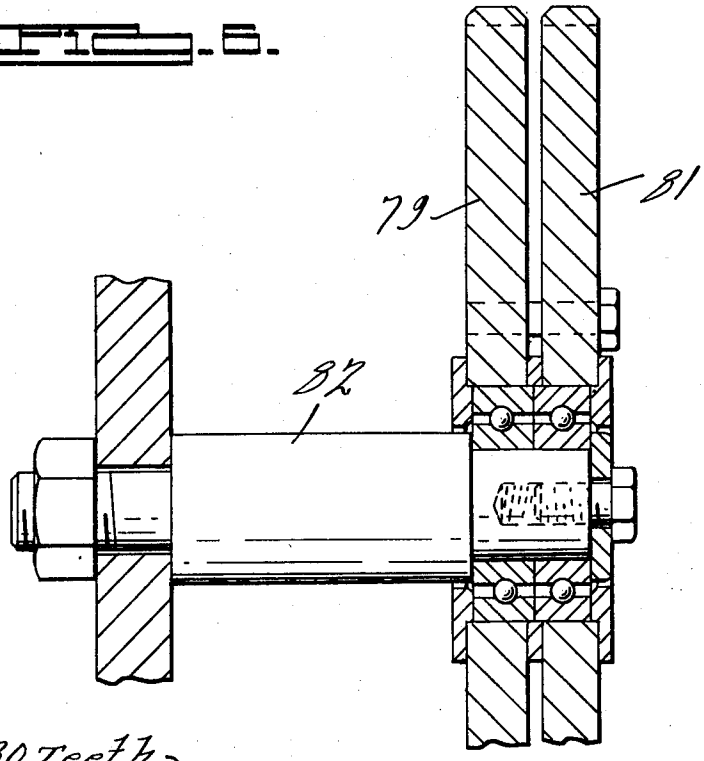


FIG. 4.

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FIG. 6.



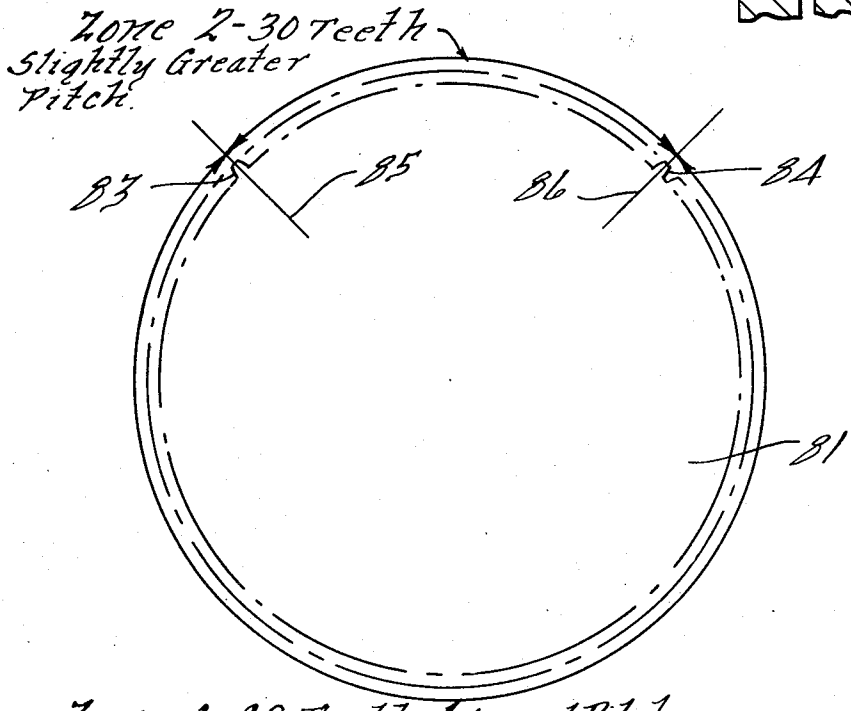


FIG. 7.

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WEB PRINTING MEANS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to the printing of ruled sheets such as are used in loose-leaf books and which have margin lines. More particularly, the invention concerns the printing of margin lines on a web which is later cut into sheets each of which has a plurality of individual leaves. After the ruled lines and margin lines are printed on the web and the web cut into sheets, the latter are formed into a stack and collated. It is necessary to provide a trim allowance at opposite ends of each sheet and to do this the margin lines, which are printed at right angles to the constantly moving web, must periodically be spaced wider apart. For example, when printing sheets each of which has four leaves of 8 × 10 ½ inch paper, three margin lines must be printed eight inches apart and the fourth margin line 8 ¼ inches from the third line. The web would then be cut between every pair of margin lines spaced 8 ¼ inches apart, in such a manner as to provide ⅛ inch trim allowance at each end of the collated stack of sheets.

2. Description of the Prior Art

Normally, the ruled lines are printed on the web in the direction of web movement as it travels through the printing machine, while the margin lines are printed at right angles to the web movement by a rotating roll. The conventional margin line printing roll for achieving the above described spacing would have a number of printing ridges equal to the number of margin lines on each sheet. For example, in the above described example, a roll would be provided having four margin line printing ridges so spaced that, when the roll is rotated at a constant rate, three of the margin lines will be printed 8 inches apart and the fourth line 8 ¼ inches from the third. A roll of this type is relatively expensive to construct because of the necessity of grinding four margin line ridges, and is of relatively large diameter which makes it heavier and more difficult to change when altering the cutoff length of a sheet for different leaf sizes.

BRIEF SUMMARY OF THE INVENTION

The present invention enables a relatively small diameter margin line printing roll to be manufactured while still providing the trim allowance at the proper intervals. The invention permits the roll to have less ridges than the number of margin lines on a sheet, thus saving in machining costs and providing a lighter and less expensive roll. To accomplish the necessary spacing, the roll is driven periodically at a slightly slower rate of speed while the paper moves at a constant rate. In the illustrated embodiment, the variable drive is accomplished by a gear system in which one gear has a tooth section of larger pitch than the rest of the gear.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of a machine for printing webs of ruled paper with margin lines, showing the locations of the novel margin line printing rolls;

FIG. 2 is a portion of a web showing the ruled and margin lines thereon and illustrating the trim allowance;

FIG. 3 is a plan view of a sheet after it has been cut from the web and showing the trim allowance areas;

FIG. 4 is a partial plan view of one of the margin line rolls together with its inking and counterpressure rolls as well as the driving gears therefor;

FIG. 5 is a side elevational view of the driving gears with parts broken away;

FIG. 6 is a cross-sectional view in elevation showing the mounting of and connection between two gears in the drive train for the margin line roll; and

FIG. 7 is a schematic view showing the tooth construction of the gear which drives the margin line roll.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention is intended to be used in conjunction with a web printing machine such as that generally indicated in **11** in FIG. **1**. This machine has a driving motor **12** which operates driven means **13** for a web of paper **14** being fed therethrough. Web **14** is also shown in FIG. **2** and the printing machine prints ruled lines **15** thereon as well as margin lines **16**, **17**, **18** and **19**. After the web is printed, a cutter **21** will cut the web into a series of sheets generally indicated at **22** in FIG. **3**. Each sheet is later cut into a plurality of leaves. For example sheet **22** has 12 leaves **23** through **35**. After sheets **22** leave cross cutter **21**, they are stacked in piles perhaps 60 inches high and shipped to the customer or to another location, where they are cut into single leaves by a paper cutting machine (not shown) known as a guillotine. For this purpose the sheets are placed in stacks of perhaps 600 to 1.000. It is this paper cutting machine which will trim the edges **36** and **37** of sheets **22**, and these edges are therefore referred to as a "trim allowance."

Ruling machine **11** has a first margin line printing station generally indicated at **38**, a second margin line printing station generally indicated at **39**, a first rule line printing station generally indicated at **41** and a second rule line printing station generally indicated at **42**. At each of these stations, web **14** passes between a counterpressure roller and a printing roll. More particularly, station **38** has a margin line printing roll **43**, a counterpressure roller **44** and inking rolls **45** and **46**. Similarly, station **39** has a margin line printing roll **47**, a counterpressure roller **48** and printing rolls **49** and **51**. The first rule line printing station **41** has a printing roll **52**, a counterpressure roller **53** and inking rolls **54** and **55**. Second rule line printing station **42** similarly has a printing roll **56**, a counterpressure roller **57** and inking rolls **58** and **59**.

A mentioned previously, it is an object of the invention to print the margin lines such that each fourth space between the lines will be slightly greater than the other three spaces. For example if 8 × 10 ½ inch leaves are being printed, the gap between margin lines **16** and **17**, **17** and **18**, and **18** and **19** will be **8** inches apiece but the gap between margin line **19** and the next margin line **16**, and the gap between margin line **16** and the previous margin line **19** (See FIG. **2**) will be 8 ¼ inches. When the web passes through cross cutter **21**, it will be cut along lines **61** and **62** to form each sheet. These lines will be 32 ¼ inches apart. The cuts will leave the trim allowance areas **36** and **37**, and the stacks of sheets will later be trimmed as indicated by lines **63** and **64**.

In order to achieve proper spacing of margin lines **16** through **19**, printing rolls **43** and **47** are each provided

with two printing ridges 65 and 66 spaced 180° apart. Counterpressure roller 44 is mounted on a shaft 67 carrying a wheel 68, the wheel being driven from member 13 through a chain 69. A gear 71 is mounted on shaft 67 and drives a gear 72 which is loosely mounted on shaft 73 supporting printing roll 43. Gear 72 in turn drives gear 74 on shaft 75 which supports inking roll 45, gear 74 driving gear 76 mounted on shaft 77 of inking roll 46. The drive ratios are such that counterpressure roller 44 will be rotated at the same speed as the web.

A gear 78 is secured to a shaft 73 and is driven through a pair of coaxial gears 79 and 81 which are affixed to each other and mounted on a countershaft 82 as seen in FIG. 6. Gear 79 has equidistantly spaced teeth around its entire periphery whereas gear 81 has the same tooth spacing around three-fourths of its periphery and a slightly greater tooth spacing in the remaining quarter segment. Gear 72 drives gear 79 while gear 81 drives gear 78, the tooth pitch of which is the same as that of gear 79.

In a typical example, gear 71 may have 48 teeth, gear 72, 64 teeth; gear 79, 129 teeth; gear 81, 128 teeth; and gear 78, 64 teeth. Gear 81 will have two zones of teeth as shown in FIG. 7. The pitch of the teeth in Zone 1 which occupies about 270° will be such that if this pitch were continued entirely around the gear it would have 129 teeth, that is, the same as gear 79. However the teeth in Zone 2 will have a slightly larger pitch so that there are 30 teeth in this zone instead of 31.

The teeth in Zone 1, two of which are illustrated at 83 and 84, will be completed past the border lines 85 and 86 respectively of Zone 1. The purpose of this is to insure that ridges 65 and 66 on printing roll 43 will be moving at the same speed as web 14 when they engage the web.

In operation, web 14 will be moved at a constant speed by the counterpressure rollers and roller 43 (or 47) will also be rotated at a constant speed as long as gear 78 is being driven by Zone 1 of gear 81. This will print three margin lines 17, 18 and 19 so that the spaces between lines 16 and 17, lines 17 and 18, and lines 18 and 19 are the same, for example, 8 inches. Since roll 43 has only two ridges, line 17 may for example be printed by ridge 65, line 18 by ridge 66 and line 19 by ridge 65. After line 19 has been printed, gear 78 will begin to be driven by Zone 2 of gear 81 which has a larger pitch and therefore one missing tooth. Roll 43 will thus be rotated at a slower rate so that by the time ridge 66 engages web 14, the web will have traveled a slightly greater distance than it traveled for the other three gaps between margin lines. Therefore, line 16 will be printed 8 ¼ inches from line 19. Immediately thereafter, Zone 1 will begin to drive gear 78 and roll 43 will be rotated at the proper speed to print the margin line gaps 8 inches apart. This cycle will be repeated so that each fourth gap is slightly greater than the other three. This will leave room for the aforesaid trim allowance areas 36 and 37, the web being cut into sheets at cross cutter 21 along lines 61 and 62 as seen in FIG. 2.

What is claimed is:

1. Means for printing margin lines in a web moving at constant speed through a ruling machine such that the web may be cut into sheets having a predetermined number of leaves lengthwise with a trim allowance at opposite ends of the sheet, said means comprising a margin line printing roll rotatable on an axis at right angles to the direction of web movement and having at least one margin line printing ridge on its surface extending parallel to its axis, the number of ridges being less than said predetermined number, and means for rotating said roll at a rate with respect to the rate of movement of said web such that all but one of the gaps between the margin lines on each sheet will be equal to the leaf width and the remaining gap will be slightly greater, thereby providing a trim allowance at opposite edges of the sheet when it is cut from the web.

2. The combination according to claim 1, said last-mentioned means comprising a driven gear connected to said roll and having equidistantly spaced teeth entirely around its periphery, and a driving gear meshing with said driven gear, said driving gear having a first zone of teeth with a pitch equal to that of the driven gear teeth, and a second zone with teeth having a slightly greater pitch, said second zone driving said roll at a slightly slower rate than said first zone, whereby said greater margin line gap will be created.

3. The combination according to claim 2, said sheet having four leaves lengthwise, said roll having two ridges, whereby each ridge prints two margin lines per sheet.

4. The combination according to claim 3, said second zone of teeth occupying approximately one quarter of the driving gear circumference and having one less tooth than each of the other quarter segments on said driving gear.

5. The combination according to claim 2, further provided with a counterpressure roller opposite said margin line roll, a shaft for said margin line roll, said driven gear being fixed to said shaft, a shaft for said counterpressure roller, means driving said counterpressure roller shaft, a gear on said counterpressure roller shaft, a gear rotatably mounted on said margin line roll shaft and driven by the gear on said counterpressure roller shaft, and a gear fixed to and co-axial with said driving gear and driven by said freely rotatable gear.

6. The combination according to claim 5, both gears on said margin line roll shaft having the same number of teeth with the same pitch, said gear fixed to the driving gear also having teeth with the same pitch around its entire periphery.

7. In a ruling machine for printing ruled lines and margin lines on a web and cross cutting said web to form sheets each of which has a predetermined number of leaves lengthwise with each leaf having a predetermined width, means for providing a trim allowance at opposite ends of said sheets comprising means for moving said web at a constant speed, a margin line printing roll adjacent said web rotatable on an axis transverse to the web movement and having at least one margin line printing ridge extending parallel to its axis, the number of margin line printing ridges being less than said predetermined number of leaves on a sheet, a counterpressure roller opposite said margin line printing roll, means driving said counterpressure roller at a constant speed, shafts for said counterpressure roller and margin line printing roll, a gear rotatably mounted on said margin line printing roll shaft driven by a gear secured to

said counterpressure roller shaft, said gears having a predetermined pitch around their entire periphery, first and second coaxial gears on a countershaft, the first gear being driven by and having the same tooth pitch as the gear on said margin line printing roll shaft, the second gear having a first zone of teeth with said predetermined pitch and a second zone of teeth with a slightly greater pitch, whereby all but one of the gaps between margin lines on each sheet will have said predetermined width but the slightly slower rotation of the margin line roll when driven by said second tooth zone will increase the size of the remaining gap, so that the sheet may be cut with said trim allowance at both ends.

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