Sept. 19, 1950 F. N. GUILBERT 2,522,784

METHOD OF AND MEANS FOR PRINTING AND PUNCHING CONTINUOUS WEBS

Filed July 20, 1944 3 Sheets-Sheet 1

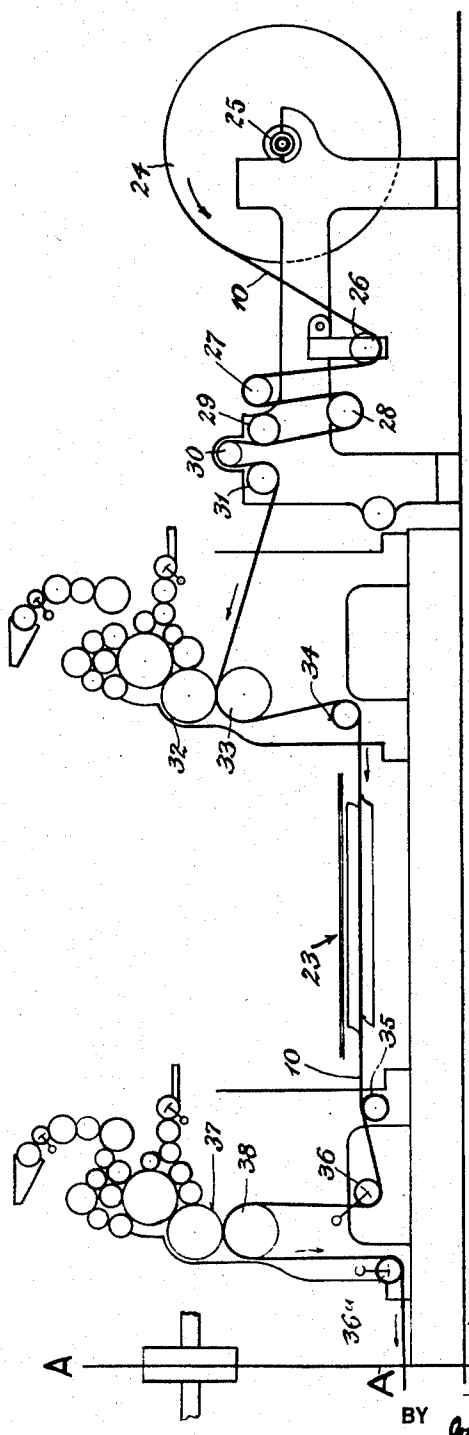

Fig. 1

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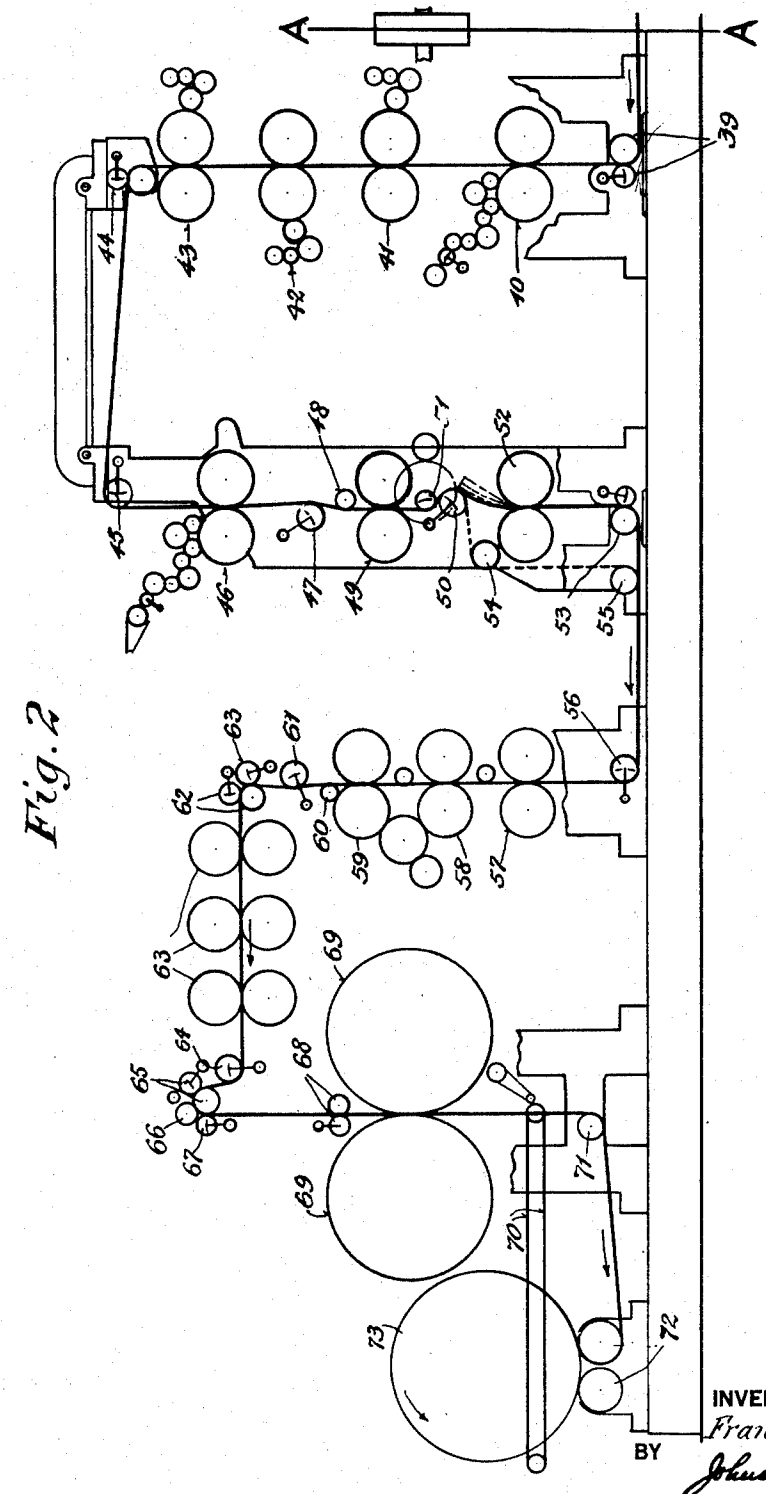

Fig. 2

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Fig. 3

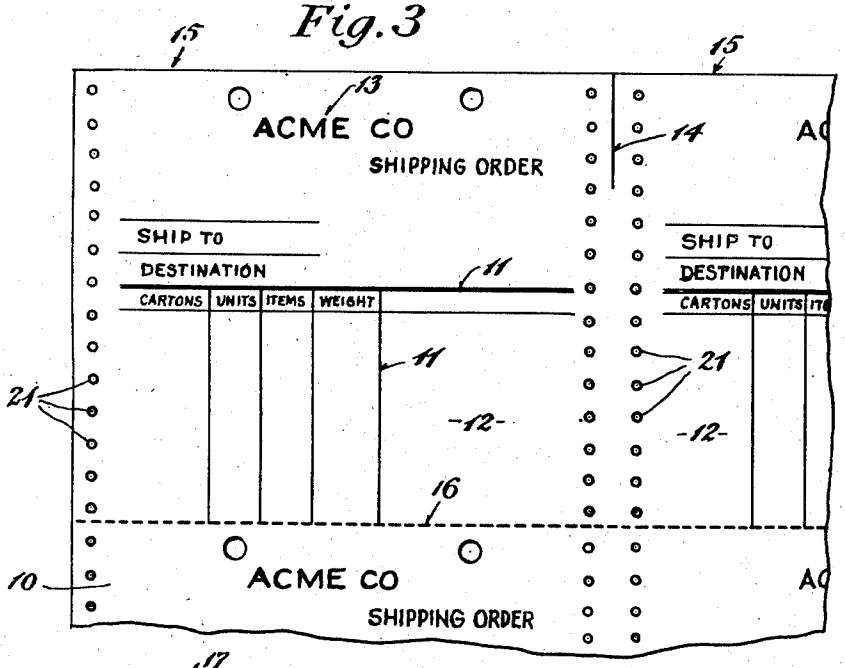
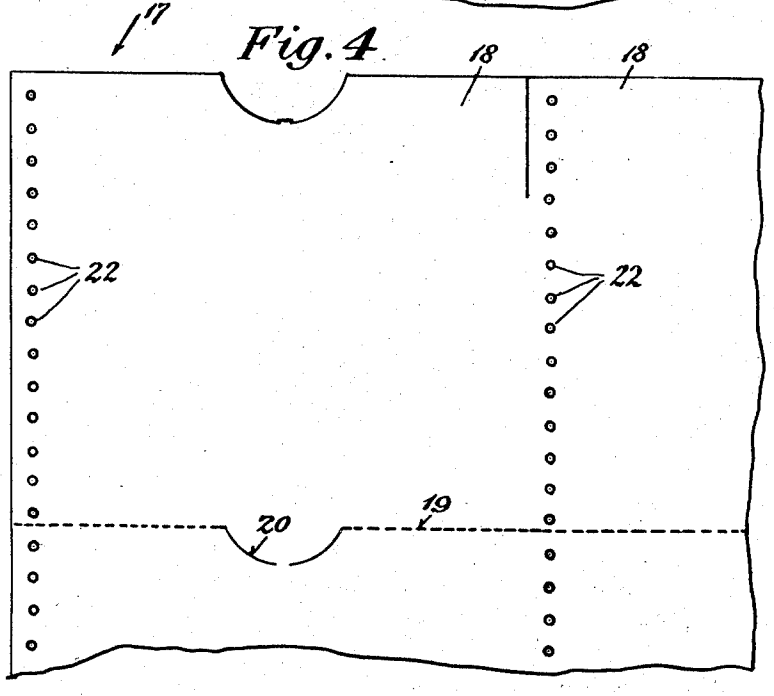


Fig. 4



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METHOD OF AND MEANS FOR PRINTING AND PUNCHING CONTINUOUS WEBS

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4 Claims. (Cl. 101—227)

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This invention relates to the art of printing, and more particularly to printing and otherwise preparing continuous webs.

In printing continuous manifolding forms, it is important that on the printed continuous strips all the forms are exactly the same length, or at least that any minute variations which exist between any two forms be casual and not regular so as to be cumulative.

In the use of such forms, the continuous strips are superposed and interposed with transfer material, and unless all the strips for a given number of forms are of the same length, the transferred writings will not appear in the same designated spaces on all the forms of a superposed set. The problem is accentuated where the strips which are being printed are also punched to produce longitudinally extending feed and position controlling apertures, for in such cases when the strips are used, the pinwheels engaging the apertures will positively feed the strips and thus not only cause the strips to be held out of depthwise registry but will actually produce such misalignment in the feeding operation unless the punch holes in each form are located in the same places on all of the strips in the superposed set.

For many years it has been a vexing problem to so control the tension of the web feeding through the printing press that after the webs are printed and fed from the press the forms will be of uniform length and the spacing of the feeding holes will likewise be accurate and uniform. Many attempts to solve this problem, or to reduce it, have been made and they have been partially successful, but they have depended upon the skill and technique of the printer and involved considerable waste of time and paper. For instance, the takeoff rolls immediately next to the mill roll were power driven and had their power variable so that they could place a variable amount of tension on the web before it entered the printing couples of the press. Once the tension was adjusted for a particular weight, quality or color of paper, it would remain constant while the press continued to run. However, if the press had to be stopped for any reason, when it was started again the tension on the web at the beginning of the new run would be different from what it was previously. This difference was so great that when it was necessary to stop the press, the printer had to overrun the forms, that is run a quantity in excess of that needed, and tear out and destroy those forms which were fed from the beginning of the run until the tension was again properly adjusted. This caused a substantial economic loss not only of the paper but of the time which it took to run off the quantity of paper which had to be discarded, and also the loss of time of the man in running and adjusting the press and the time required to reset the numbering attachment used to consecutively number the forms. In addition, with the tensioning device heretofore used, the tension had to be changed for every different weight of paper, and even for different colors of the same weight of paper, and for papers of different texture.

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In manifolding forms, the record strips are usually made somewhat heavier than the one-time carbon strips with which they are to be collated. These carbon strips have to be fabricated or processed. For instance, they have to be transversely perforated to divide them into form lengths, punched for the separation tab, and side punched for the pinwheel feed. Also, in the same collated pile of strips, the original and carbon copies frequently varied in weight or color or both.

In order that as little discrepancy as possible would be produced between these various strips which are collated for use, it is desirable to print or process the strips in the same press, yet doing this gave no advantage heretofore because each time the weight or character of the paper was changed the pressman had to go through the operation of varying the tension on the strip until, by measuring, he could observe that the spacings between the feed holes and the length of the form were accurate. Even, by these tests, the printer could not be sure of the correct adjustment of the tension, since the discrepancies might be so small that, because of the physical limitations on his ability to measure in the press, they would not show up unless forty or fifty feet of the strips were laid out and measured together.

The present invention has solved these problems in an extremely simple manner. This was done in such a way as to simplify the operations to be performed by the printer and without adding to, or complicating the construction of, the printing press.

More specifically, the difficulties heretofore encountered have been avoided by leading the web to the first printing and pressure cylinder couple in a substantially untensioned and unstretched condition and controlling the feed of the web to and through the printing couple by

the peripheral speed of the first printing couple and controlling the advancement and feed of the web through the printing press where it may be processed by other printing couples and punching and perforating devices in such a way that the web is presented to each, where registration is important or essential, in an unstretched condition.

I have found by actual practice that the web may be satisfactorily passed through the printing and other processing units without being stretched by leading the web from a free turning mill roll to the first printing couple over guide rollers which likewise are free turning so as not to place any appreciable drag on the web, drawing the web off the mill roll by the frictional contact of the web with the printing couple, and feeding the web through the press by one or more sets of feed rollers, the peripheral speeds of which are sufficiently increased over that of the printing couple as to compensate for unavoidable slippage between the feed rollers and the web.

The present invention may advantageously be employed in processing continuous strips whether or not they have printing performed on them so long as the relative position of the physical alterations of the strip is critical or at least may not have cumulative discrepancies between them.

For instance, in producing the one-time carbon strips which are interleaved with the printed record strips, these are provided with one or more longitudinally extending rows of feeding apertures, transverse lines of weakness between form lengths, and other punching or cutting such as the semicircular incisions to form tabs and notches on the ends of the carbon strips when the strips are severed into sheet lengths. Should the transverse perforations be placed in the sheet when it is stretched to one extent and the feeding holes be punched therein when the strip is contracted or stretched to another extent, when the strips are superposed with record strips and fed through the typewriting machine, the transverse severing lines in the carbon strips will ultimately become improperly positioned with respect to the transverse severing lines in the record sheets.

By processing the carbon strips according to the present invention, where the operations are performed while the strip is substantially unstretched, the desired relation between lengths of the sheet-lengths and the physical alterations of the strips throughout their length is maintained.

Other features and advantages will hereinafter appear.

In the accompanying drawings:

Figures 1 and 2 are schematic views of the front and rear of a printing press arranged according to the present invention, and by means of which the methods of the present invention may be practiced, the press being divided for the purpose of illustrating the same on two sheets on the lines A—A, Figs. 1 and 2.

Fig. 3 is a plan view of a fragment of a web prepared to act as record strips for manifolding use.

Fig. 4 is a fragment of a web prepared to act as transfer strips between the record strips shown in Fig. 3.

In the manufacture of continuous manifolding forms, the printing and other processing of the web is performed in a web printing press.

As shown in Fig. 3, the web 10, by way of example, may have horizontal and vertical lines 11 printed thereon to form spaces 12 usually designated to indicate the indicia to be placed in them, and other printing such as a heading 13. The web is divided longitudinally as by a slit 14 to provide a plurality of strips 15 which, when superposed and interleaved with suitable transfer material, may simultaneously receive typewritten impressions on corresponding places on the several strips. The strips 15 are divided transversely by weakening lines 16 along which they may be torn or otherwise severed to produce sheet lengths.

In Fig. 4, there is illustrated a web 17 from which transfer strips 18 are made. Such transfer strips are divided transversely by weakening lines 19 to form sheet lengths and are provided with arcuate incisions 20 on the weakening lines 19 to produce tabs and finger grips used for carbon separation purposes after the superposed record and carbon strips are torn into sheet lengths. Preferably, the carbon strips are prepared in the same printing press as the record strips.

In order to maintain the printing on the several strips 15 in registry depthwise and in proper relation with a typewriter platen with which they are used, the web 10 is usually provided with longitudinally extending rows of pinwheel engaging holes 21. Likewise, the carbon strips 17 shown in Fig. 4 are usually provided with one or more longitudinal rows of pinwheel engaging apertures 22 and these maintain transverse lines of separation 19 in the carbon strips 18 in registry with the transverse lines of perforations 16 in the record strips 15.

In preparing the record and transfer strips, it has been difficult and costly, for reasons stated above, to maintain the feeding holes 21, or their physical alterations such as the transverse tear line 16, in such predetermined and uniform relationship to the printed matter 11 and 12 that this relationship is maintained over long stretches of the web. If such relationship is not maintained with the superposed strips being held by the feeding pins, the printed matter in the several strips would be out of alignment, with the result that writing performed in one designated space might appear in another one. Even if the discrepancies were slight between adjacent forms or sheet lengths, if they are cumulative, the difficulty becomes serious. Also, if the transverse weakening lines, which also constitute fold lines on which the superposed strips are zigzag folded to make a packet, are not maintained at uniform spacing throughout the length of the strip, the folded pack will not be square and straight.

Likewise, if the relationship between the transverse tear lines 19 in the carbon strips and the feed holes 22 is not maintained, the tear lines of the record sheets and carbon sheets will not be in registry depthwise and the leading edges of the sheets will not be even.

In addition, this predetermined relationship must be maintained between the printing and physical alterations of one strip relative to those of another regardless of whether they are printed at the same or different times or on the same or different webs.

To avoid these difficulties, it was customary heretofore to tension the web as it passes to and through the printing press so that on the finished web the desired relationship would be maintained. This could be done with a great deal of time and patience in making ready, but once

the press stopped, when it was restarted again the tension at the beginning of the run became different and the paper prepared while the press was accelerating had to be torn out and discarded. The tension had to be changed with different weights of paper and different colors for reasons not well understood heretofore.

The present invention solves all these problems and is based on the supposition that the difficulties heretofore encountered arose from the fact that the paper, upon being tensioned, stretched more or less and stretched different at the beginning of the run than during the remainder of the run of the press. Also, that the contraction of the paper was different for different qualities and compositions and that therefore only by a cut and try method was it possible to obtain satisfactory results by controlling the tension of the paper. The present invention solves the problem in a simple and practical manner by running the paper to and through the printing couples and other processing units of the press in a substantially untensioned and unstretched condition.

In the form of the invention herein illustrated as exemplary thereof, this is accomplished by mounting a mill roll **24** on suitable antifriction bearings **25** so that it is substantially free turning. From the mill roll, the web **10** passes over a dancing roller **26** and guide rollers **27** and **28** as usual. These also are free turning. From the guide roller **28** the web may pass over rollers **29**, **30** and **31** of the usual tensioning device, but the roller **30** is spaced from the rollers **29** and **31** which may or may not be power driven as desired. If the rollers **29** and **31** are not power driven they, as well as roller **30**, should be free turning, but if they are power driven their speed should be such that they rotate at the traveling speed of the paper and neither advance nor hinder the movement of the paper. From the roller **31** the web is led to the bite of the printing cylinder **32** and pressure cylinder **33** of the first printing couple. As shown, the printing couple is of the offset type and accordingly the cylinder **32** is a blanket cylinder. As shown, the feeding contact between the web and the cylinders **32** and **33** draws the web from the mill roll, and this arrangement has been found entirely satisfactory. As stated, however, if desired, the load of turning the mill roll may be partially taken from the cylinders **32** and **33** by causing the rollers **29**, **30** and **31** to rotate without however having feeding interengagement with each other. Thus it will be seen that, according to the present invention, the web is printed upon in an untensioned and unstretched condition.

From the cylinder **33** the paper is guided over a guide roll **34** and thence over a guide roll **35** to an adjustable roller **36** and then over and between impression and printing cylinders **37** and **38** of a second printing couple, then over another adjustable roller **36***a* to feed rollers **39**. The feed rollers **39** are driven at a slightly greater peripheral speed than the printing couple cylinders **32—33**, **37—38**, but this increase is of such an order as to act as a frictional take-up and only compensate for the unavoidable slippage between the rollers and the web. Thus the web passes from the feed rollers **39** to the next processing unit again in a substantially untensioned and unstretched condition. The web thus passes up through a back printing couple **40**, a numbering couple **41**, a back numbering couple **42**, and a second numbering couple **43**. From the latter the

web passes through feed rollers **44** to an adjustable roller **45** and then to a supplemental face printing couple **46** past adjustable roller **47** and cooperating fixed roller **48** to a side punching unit **49** for providing binding holes or other holes and then past another adjustable roller **50** and its cooperating fixed roller **51**. If the web is to be provided with longitudinally extending rows of pinwheel engaging holes **21** or **22**, it is then led through hole-punching cylinders **52** and down through feed rollers **53**. If it is not to be so provided, it may by-pass the punching cylinders **52** by passing over a guide roller **54** as shown in dotted lines. In either case, it passes under a guide roller **55** to an adjustable roller **56** where it passes up through other punching units **57**, **58** and **59**, then past a fixed roller **60** and adjustable roller **61** to feed rollers **62** at which point the web may be longitudinally perforated or weakened by a perforating unit **63**. From the feed rollers **62**, the web passes through transverse perforating or weakening units **63** over an adjustable roller **64** to feed rollers **65** where it may be provided with other longitudinal perforations by perforating units **66** and **67**. The web then descends to longitudinal slitting rollers **68** where it may pass through folding cylinders **69** where it may be transversely folded and deposited on a conveyor **70**. If the web is to be rewound in a roll, it passes idly between the folding cylinders to a guide roller **71** and then to contact rewinding rollers **72** by which it is wound on a roll **73**.

Turning bars **23** located between the guide rollers **34** and **35** may be used to turn the web between the first and second printing couples so that the underside of the web faces up for back printing.

Provision is made whereby any of the punching, numbering, perforating or folding units may be made inoperative or idle, or may be by-passed when the particular work being done does not require their use.

The adjustable rollers **36**, **36***a*, **45**, **47**, **50**, **56**, **61** and **64** are to increase or decrease the length of the bight of the web between the several processing units so that subsequent operations may be performed on the web in the exact place desired with relation to previously performed operations and are adjusted in making ready according to the requirements of the particular work being done. They do not provide any drag or tension on the web.

Since, to carry out the present invention, the web is to pass to and through some or all of the various processing units in an unstretched and untensioned condition, and since there is a determinable amount of slippage between the web and the feeding or propelling rollers, the present invention provides succeeding feeding rollers with slightly increasing peripheral or feeding speeds, and this is preferably done by having the succeeding rollers slightly greater in circumference from the receiving to the delivering end of the press.

Preferably, also, according to the present invention, the pressure and blanket cylinders are built up or reduced in diameter so that the web will be on the pitch diameter of the driving gears which are positively coupled to the feed rollers. Hence, the desired relative speeds of the printing couples and the feed rollers can be maintained so that the web will pass through the press in an untensioned and unstretched condition.

Thus, the web will encounter the punching unit **52**, for instance, in exactly the same condition

as it did the printing couples and this whether the press is operating fast or slow or is starting or stopping. Likewise, the same relationship between the various operations or physical alterations will be maintained on different webs whether they are processed in the same or a like press, or whether the webs are of a different weight or different color or texture or composition, since, in each case, they will be processed at nil tension and stretch, the problems heretofore attendant upon tensioning the web, maintaining it uniform, and compensating for variations in stretch or elongation and longitudinal contraction of the web when released from the tension—all of which are aggravated by variation in temperature and humidity of the web and the air in which it is processed—are obviated, and the loss of productive time of labor and the press and the material spoiled avoided.

Variations and modifications may be made within the scope of this invention and portions of the improvements may be used without others.

I claim:

1. In the art of printing continuous webs having a succession of printed sheet lengths, the steps which include pulling the web from a substantially frictionless supply by frictional web contacting engagement between the printing and pressure cylinders of a first printing couple without applying substantial frictional drag to the web between said first couple and the supply sufficient to stretch the web, and feeding the web through successive web processing couples by successive rotary web contacting devices, each having a peripheral speed which is increased over that of the printing couple and preceding device sufficient to compensate for slippage between the web and web contacting device to maintain the web substantially unstretched as it is acted upon by said web processing couples.

2. In the art of printing continuous webs having a succession of printed sheet lengths, the steps which include leading the web to be printed from a free turning supply roll to a first printing couple, pulling the web from the supply roll by frictional web contacting engagement between the printing and pressure cylinders of said first printing couple without applying substantial frictional drag to the roll or the web between said first couple and the roll sufficient to stretch the web, and feeding the web through successive web processing devices by successive rotary web contacting devices, each having a peripheral speed which is increased over that of the printing couple and preceding web contacting device sufficient to compensate for slippage between the web and web contacting device to maintain the web substantially unstretched as it is acted upon by said web processing devices.

3. In the art of making continuous webs divided into a succession of printed sheet lengths by transverse perforations and having coordinately punched feed-holes extending in longitudinal rows, the steps which include leading the web to be printed from a free turning supply roll to a first printing couple, pulling the web from the supply roll by frictional web contacting engagement between the printing and pressure cylinders of said first printing couple without applying substantial frictional drag to the roll of the web between said first couple and the roll sufficient to stretch the web, and feeding the web through successive printing, perforating and punching couples by successive rotary web contacting devices, each having a peripheral speed which is increased over that of the first printing couple and preceding device sufficient to compensate for slippage between the web and web contacting device to maintain the web substantially unstretched as it is acted upon by said web processing couples.

4. In a printing press, means for substantially frictionlessly mounting a supply roll so that a web may be drawn therefrom with a minimum of drag-producing friction; guide rollers operative to engage and guide the web without tensioning or stretching the web; a printing couple receiving the web directly from said guide rollers and frictionally engaging the web to draw the same from the supply roll and feed the same over the guide rollers; web processing units beyond the printing couple; and means for feeding the web to and through said units at substantially the same velocity as that produced by the said printing couple including successive feed rollers between said units, and means for rotating each succeeding feed roller at a higher peripheral speed than the preceding roller to compensate for slippage between the web and roller so as to maintain the web in substantially the same untensioned and unstretched condition while being subsequently processed as it was when initially being printed upon by said printing couple.

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