

[54] **WEB REGISTRATION IN AN
INTERMITTANTLY FED ROTARY
PRINTING PRESS**

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[58] Field of Search 101/182, 181, 228, 219,
101/173, 141

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Primary Examiner—J. Reed Fisher

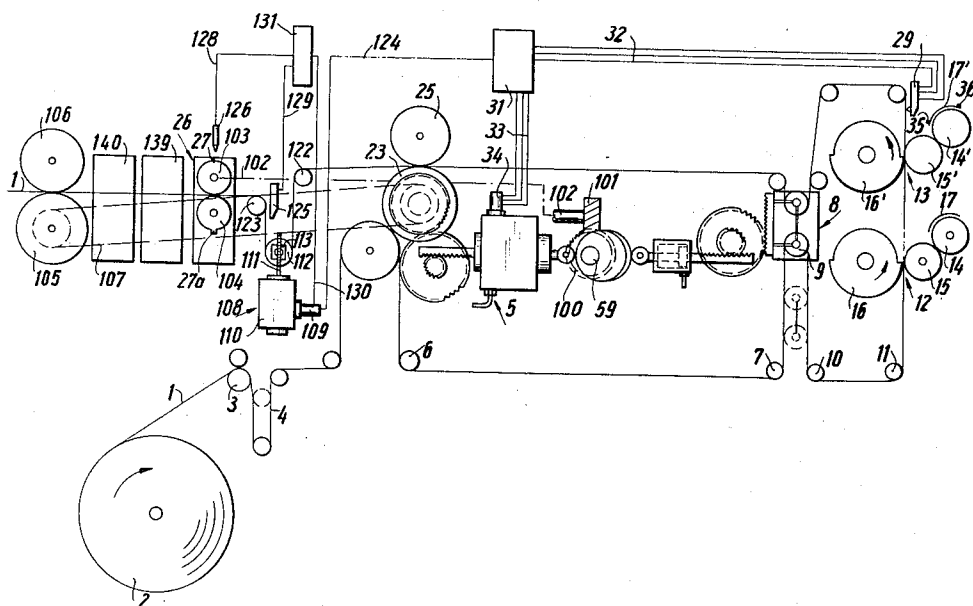
Assistant Examiner—Paul J. Hirsch

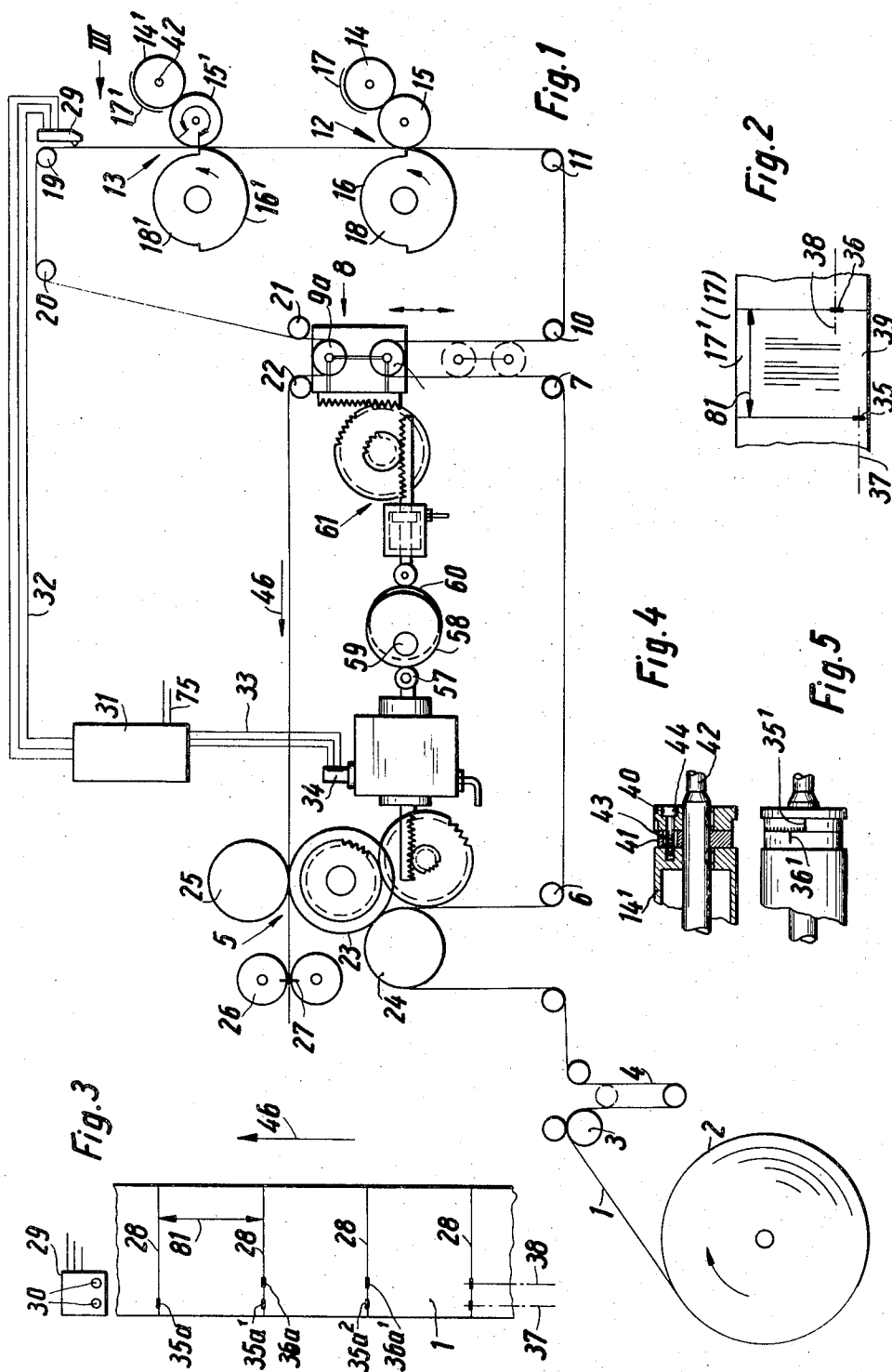
Attorney, Agent, or Firm—McGlew and Tuttle

[57] **ABSTRACT**

The forms are particularly endless forms having transversely extending lines of perforations. The press includes printing mechanisms having plate cylinders carrying plates extending through part of their circumferential peripheries, an equalizing carriage adapting web-shaped printing material, fed intermittently from a supply loop thereof, to the peripheral speed of the plate cylinders and executing a return movement during the printing interval, rolls carried by the equalizing carriage and looped by the printing material, and a main traction device, adjustable to the form length, with a main traction roll driven intermittently in the direction of traction and cooperable with pressure rolls. Printing means are provided either on the printing plates or on relatively adjustable rings on the plate cylinders to print adjusting marks on the printing material at the leading and trailing ends of each form length. Preferably the two marks on each form length are at respective different distances from an edge of the form, and are linear marks aligned with the respective form length ends to be perforated.

16 Claims, 14 Drawing Figures





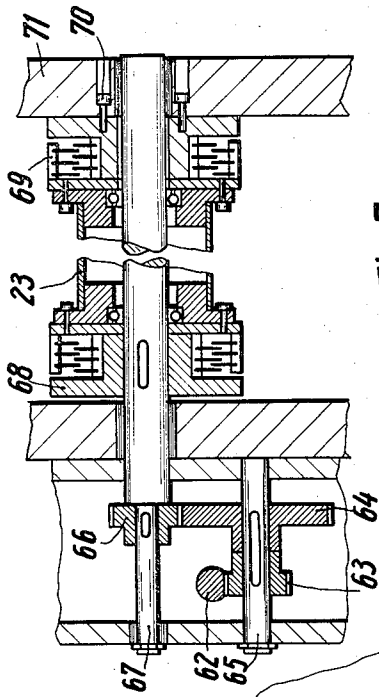


Fig. 7

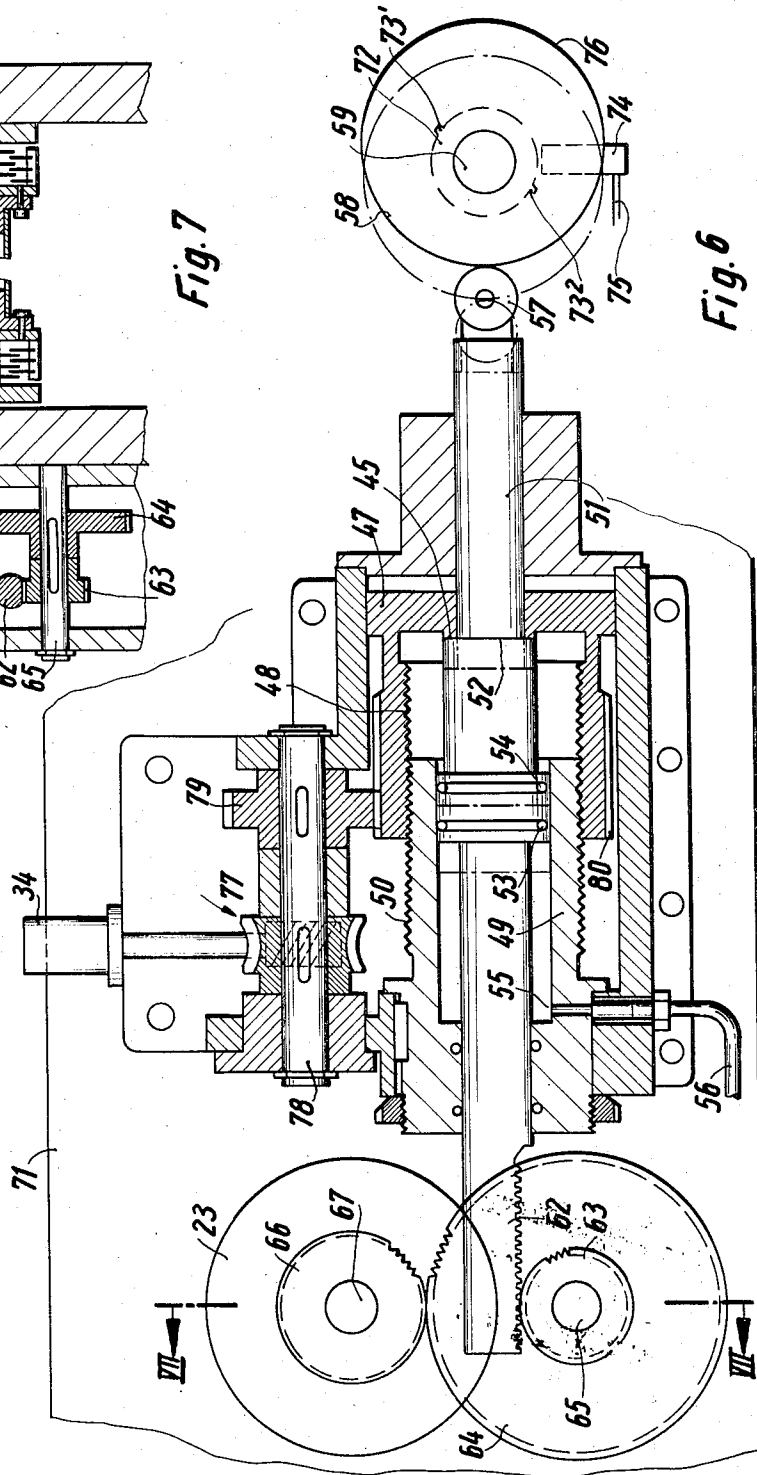


Fig. 6

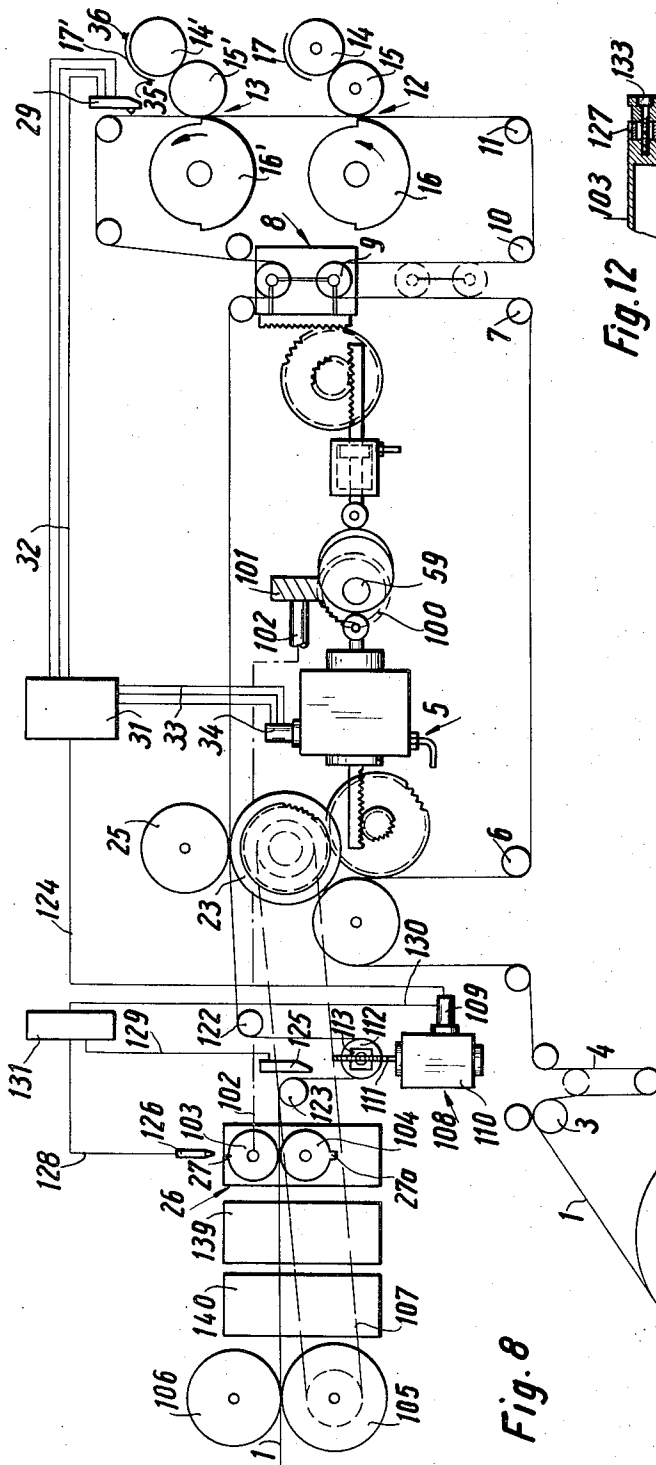


Fig. 8

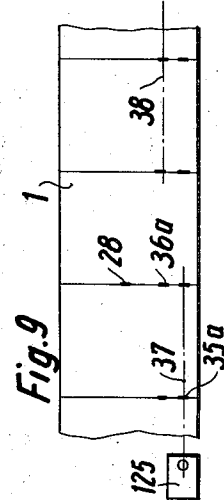


Fig. 9

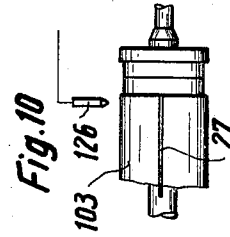


Fig. 10

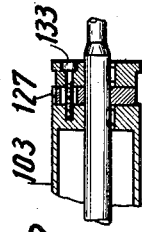


Fig. 11

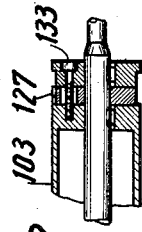
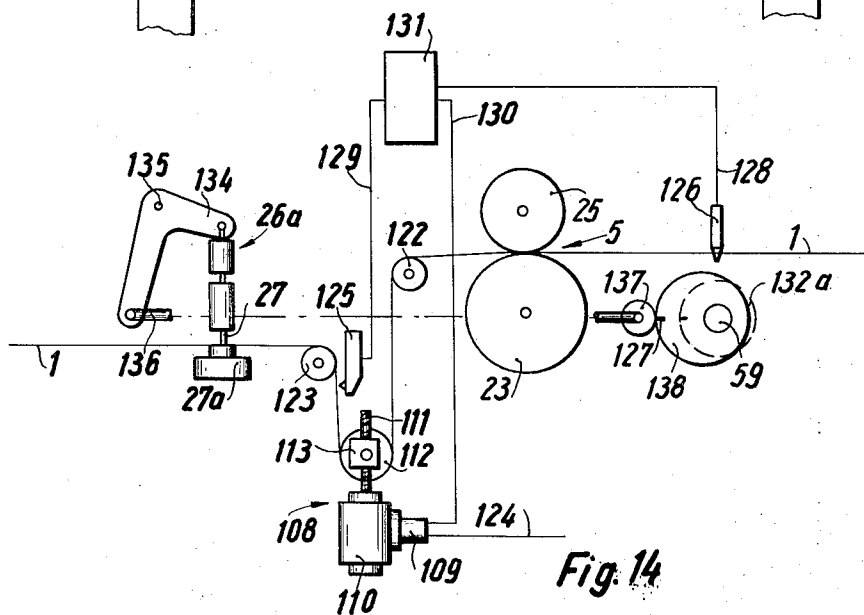
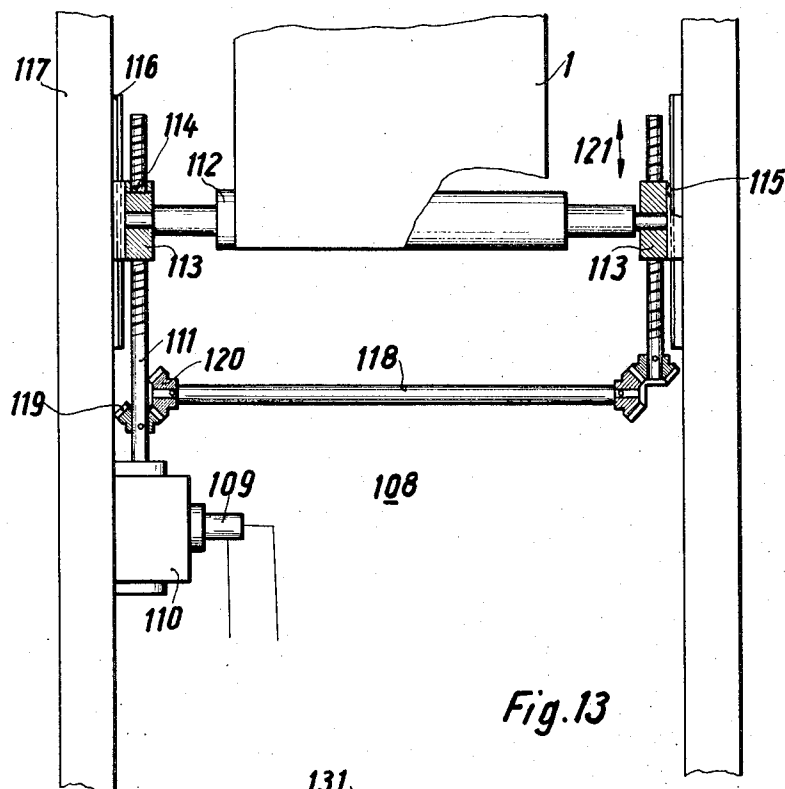


Fig. 12



WEB REGISTRATION IN AN INTERMITTANTLY FED ROTARY PRINTING PRESS

FIELD AND BACKGROUND OF THE INVENTION

The invention relates to a rotary printing press for variable forms of printing material, particularly endless forms having transversely extending lines of perforations, with printing mechanisms whose plate cylinders carry printing plates extending over part of their circumferences. The press has an equalizing carriage adapting the web-shaped printing material, fed intermittently from a supply loop thereof, to the circumferential or peripheral speed of the plate cylinders, and which executes a return movement during the printing interval. The equalizing carriage carries rolls looped by the printing material, and the press includes a main traction device adjustable to the form length and having a main traction roll cooperable with pressure rolls, and driven intermittently in the direction of traction or movement of the web of printed material.

Heretofore, setting to different length forms has been possible only manually, with all the related adjustments. The setting proper must be effected on the gear connected with the main traction roll and operating the latter. As known to those skilled in the art, the main traction roll performs an intermittent rotary movement which is always in the same direction, the paper web being pulled through in one direction and the forms adjoining each other without any gap therebetween.

Since the main traction roll stands still during the printing operation, while the printing takes place with the paper web passing through the printing mechanisms, a paper equalization is necessary. This is effected by an equalizing carriage which carries rolls looped by the paper web, and whose function is to perform a movement in one direction during the printing while, at the same time, the main traction roll stands still or is stationary. The equalizing carriage performs a movement in the opposite direction after the printing while the main traction roll pulls the paper web to the desired form length. Simultaneously, the equalizing carriage pulls out a loop of the required paper length from the existing supply loop.

Up until now, the form length has been set, on the main traction device, on an existing crank drive and, to this end, the crank pin has been shifted in accordance with the required radius. It is obvious that such an adjustment is time-consuming and generally inaccurate, despite the time spent in making the adjustment. The inaccuracy of the set form length can be determined, however, only after the paper web has passed through, and the form length must be continuously readjusted until the correct form length is attained. Up until this time, a considerable amount of paper has passed through the press, and this represents waste.

In addition, it can happen that the set form length changes, due to changes in external influences, such as the degree of moisture and the paper expansion with variable paper thickness. The result would be an irregular stack of endless forms, which are discharged, as known to those skilled in the art, in zig-zag form from the rotary printing press.

SUMMARY OF THE INVENTION

The problem to which the present invention is di-

rected is that of simplifying the setting of the machine to a certain form length, and of supervising the maintenance of the exact form length constantly during the run of the press and to readjust it automatically, if necessary.

In accordance with the invention, this problem is solved in that printing adjusting marks are arranged at the leading and trailing ends of each form length, and that a known scanning head, for scanning the printed adjusting marks, is arranged, in the direction of movement of the web of printing material, right behind the printing mechanisms and above the printed web. An adjusting motor, controlled by the scanning head in accordance with the scanned printed adjusting marks, is connected to the main traction device and regulates the latter to maintain coincidence between the printed adjusting mark at the trailing end of each form and the printed adjusting mark at the leading end of the respective next succeeding form.

The invention represents a substantial advance over the prior art in that the form length is constantly printed, so to speak, as a standard measure during the run of the rotary printing press, by the adjusting marks defining the individual form length. This has the effect that, in forms immediately following each other, the printing mark at the leading edge of a following form, in the direction of motion, lies next to and coincides with the printing mark at the trailing edge of the preceding form, in the direction of motion, when the given form length is correct. Furthermore, any differences in position of the adjusting marks can be regulated in one or several successive comparisons, in forward or reverse runs, to the coinciding scanning position, by readjusting the main traction device. This control and readjustment is effected constantly during the run of the rotary printing press, and assures that the printed standard measure is accurately maintained at all times in the main traction device. With this arrangement, it is possible to produce straight stacks of endless forms. Preferably, the coincident position of the printed adjusting marks also determines the position of the cross line or transverse line of perforations coinciding therewith, and along which the zig-zag folding of the endless form web takes place.

It is known per se, in several printing mechanisms, to adjust the lay marks of the plate cylinders to each other by adjusting marks. To this end, each plate cylinder of a printing mechanism has a single adjusting mark which is compared with the single adjusting mark of the other plate cylinder. What is dealt with in this case is the exact registered printing of multicolor prints. Maintenance of the form length, and readjustment thereof, is not possible with these known measures, as the object of the known measures is solely to achieve registry of the print of several plate cylinders.

As distinguished from this, in accordance with the invention, not one but rather two adjusting marks are printed, namely at the leading and trailing edges of a form, and are compared with each other in the above-described manner. These adjusting marks preferably are linear and preferably are arranged in the same direction in two planes, but with respective different distances from a side edge of the printing material. To this end, the printing adjusting marks can be arranged on the printing plates, in which case they are etched, just like the printed picture. However, the printing adjusting marks can also be arranged on two adjusting rings

of the plate cylinder at one end thereof. These adjusting marks on the two adjusting rings replace the etched adjusting marks on the printing plates. In this case, there thus can be used printing plates which were not intended originally for this rotary printing press.

In further accordance with the invention, the main traction device has an end stop which can be set, by a step motor, to the form length. An adjustable end stop assures a high accuracy of the form length, since it acts as a rigid stop, together with its counter-stop. The adjustment of the end stop naturally is effected only when it is disengaged from its counter-stop or, in other words, when it is relieved.

The end stop preferably is arranged on an adjusting nut having a female thread, and threadedly engaged with a hydraulic cylinder having a male thread. The hydraulic cylinder has a plunger provided with a piston, and this plunger carries a roller engaging a continuously driven cam, so as to admit the end stop between the highest point of the curve of the cam and the end point of the dropping curve leg, as determined by the end stop. After reaching this end point, the plunger disengages itself from the further dropping curve leg of the cam while it bears hard on the end stop due to the pressure in the hydraulic cylinder, and is held until the rising cam surface engages the plunger again. In this entire interval, the main traction roll stands still, and the traction roll is again actuated only when the plunger is engaged again by the now rising part of the cam. When this is the case, the main traction roll must not turn, so that it must thus be blocked.

For this purpose, the plunger can be designed as a rack at the end opposite the cam, and can be operatively connected through a pinion and gears with the main traction shaft, with a shifting coupling being arranged between the latter and the main traction roll. The main traction roll is connected to a brake coupling which can be engaged and disengaged in alternation with the shifting coupling. The shifting coupling is engaged when the plunger moves on the dropping curve leg of the cam, and the main traction roll is actuated during this period. The brake coupling naturally is disengaged during this period. Conversely, when the plunger is engaged by the rising part of the cam, and the plunger moves away from the end stop, the brake coupling is engaged and the shifting coupling is disengaged. This has the advantage that the mass of the main traction roll, and of its associated driving parts, is disengaged by striking against the end stop and the couplings or the brake are shifted when the main traction roll stands still. The accuracy of the form length thus is substantially improved even at higher pressures.

In addition, the drive of the adjusting nut preferably is self-locking and connected by a worm-worm gear with the stepping motor. The self-locking drive of the adjusting nut prevents the adjustment of the end stop during the run of the rotary printing press from being affected by vibrations transmitted from the machine frame.

Another advantage of the invention is that the initial setting of the form can be effected on the same end stop. To this end, it is preferable to make the respective form length adjustable on the end stop by feeding setting values for the step motor as an initial setting. The setting values are numerical values from which the set form length can be read.

In a further development of the invention, the form accuracy of the transversely extending lines of perforations and constant supervision of their exact position and resetting, if necessary, is effected by a separate regulation. For this purpose, the perforating device has a known length register for guiding the paper web, and a control line connects the length register with the control of the main traction device. The length register can be adjusted simultaneously and in synchronism with the main traction device, by the same amount as the latter, to the extent of the adjusting marks. In case of deviations of the otherwise existing coincidence of the printed adjusting marks, the length difference appearing in the direction of the perforation is immediately compensated by the shifting movement initiated by the regulation. The perforation is thus aligned automatically with the coincident position of the printed adjusting marks and produced, in this setting, from perforation to perforation with automatically readjustable high accuracy.

If the longitudinal behavior of the paper web should be changed, after passing through the main traction device and up to the knife of the perforating device, by the above-mentioned influences, readjustment is still possible by the above-mentioned length register directly ahead of the perforating device and, for this purpose, there can be used again the adjusting marks printed on the paper web.

For this purpose, the perforating device can be provided with two additional scanning heads, of which the first scanning head is directed toward the adjusting marks of the paper web and the second scanning head is directed toward a marking associated with a perforating tool. Both scanning heads are connected with the adjusting motor of the length register by additional control lines and regulate the paper web to a coincident position of the adjusting marks. It is sufficient if the first scanning head is in the line of action of a marking, for example, of the outer marking, and scans this marking when the adjusting marks pass by. Since the markings printed on the paper web leave the main traction device in coincident position, the inner marking also could be scanned.

As mentioned above, the scanning is effected when the adjusting marks pass by, and naturally, in each case, in-phase with the marking associated with the perforating tool in the corresponding position of the second scanning head. In order for it not to be necessary to scan the marking of the perforating tool and the associated perforation coinciding with the adjusting mark, the marking associated with a certain position of the perforating tool can be scanned by the second scanning head at the same instant as the adjusting mark, following in the direction of motion the adjusting marks in in-phase position, which can be easily realized constructionally. There is thus attained a stagger in space of the two scanning heads and, nevertheless, a functionally equivalent readjustment of the coincident position of the cutting perforating tool with the position of the adjusting mark of the paper web. If the two do not coincide, the paper web is adjusted by the length register associated with the perforating device by the longitudinal difference determined by the two scanning heads, and the coincident position of the adjusting marks with the marking is thus restored.

For a position-correct perforation, it is necessary, in general, only to connect the main traction device oper-

atively with the perforating device by the above-mentioned control line. In this manner, it is possible to transmit the difference in length, readjusted in the main traction device from the beginning, to the perforating device, and to set it in synchronism with the main traction device so that the readjustment by means of the two scanning heads is limited to minimum amounts.

If a different form length is fed into the main traction device, the perforating device is adjusted by a corresponding shifting movement of the length register simultaneously with the adjustment of the main traction device.

The length register could regulate the adjusting marks of the paper web alone to coincidence with the perforation produced by the perforating tool, by means of the control by the two scanning heads. However, in this case, there would have to be carried out a regulating action which otherwise would have been made before, due to the presence of the control line connecting the main traction device with the length register. For the most part, these regulations of the paper web, which are effected in synchronism with the main traction device, are already sufficient. The control line between the two represents the simplest means, which makes, in most cases, the readjustment by means of the above-mentioned two scanning heads unnecessary. However, a readjustment of the paper web by the two scanning heads also yields higher velocities with respect to the perforations to be produced.

In a rotary perforating device, which has rolls provided with knives, a marking associated with the knives may be provided on the perforating roll. To this end, an adjusting ring carrying the marking may be provided at the end of the perforating roll, but it is also possible to use the edge of the knife itself as a marking.

In perforating devices with punch knives, which are driven by a bell crank in connection with a cam disc, the cam disc can carry the marking. It is also possible to use an adjusting ring with the marking on the cam disc.

An object of the invention is to provide an improved rotary printing press for variable forms of printing material.

Another object of the invention is to provide such a rotary printing press particularly designed for use with endless forms having transversely extending lines of perforations.

A further object of the invention is to simplify the setting of such a rotary printing press to a certain form length.

Another object of the invention is to supervise the maintenance of the exact form length constantly during running of the rotary press and to readjust it automatically if necessary.

Yet another object of the invention is to increase the form accuracy of the transversely extending perforation lines and to supervise constantly their exact position with resetting, if necessary, by a separate regulation.

For an understanding of the principles of the invention, reference is made to the following description of typical embodiments thereof as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the Drawings:

FIG. 1 is a schematic representation of a rotary printing press embodying the invention and adjustable to various forms, the press having two printing mechanisms, an equalizing carriage and a main traction device;

FIG. 2 is a top plan view of a printing plate with two adjusting marks which indicate the length of each form;

FIG. 3 is a plan view of the printed paper web, taken in the direction of the arrow III of FIG. 1, the paper web having adjusting marks printed thereon;

FIG. 4 is a partial sectional view of a plate cylinder with two adjusting rings;

FIG. 5 is a partial elevation view of the plate cylinder shown in FIG. 4;

FIG. 6 is a sectional view of the main traction device shown in FIG. 1;

FIG. 7 is a sectional view taken in the direction VII—VII of FIG. 6;

FIG. 8 is a schematic representation of a rotary printing press in accordance with another embodiment of the invention;

FIG. 9 is a top plan view of part of the paper web with transversely extending perforation lines and adjusting marks, of which one row is scanned by a scanning head associated with a perforating device;

FIG. 10 is a partial elevation view of a rotating perforating tool with a scanning head associated with the tool edge;

FIG. 11 is a partial elevation view of a rotating perforating tool with an adjusting ring and a scanning head associated with the marking of the adjusting ring;

FIG. 12 is a partial sectional view of the perforating tool shown in FIG. 11;

FIG. 13 is a side elevation view, partly in section, of the length register shown in FIG. 8; and

FIG. 14 is a somewhat schematic representation of a portion of the printing press illustrating a punching perforating device in place of the rotary perforating device shown in FIG. 8.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1, in the schematic representation of a rotary printing press illustrated therein, the paper web 1 is withdrawn continuously from a rotatably mounted roller 2 by a delivering mechanism 3 and is fed into a supply loop 4. From supply loop 4, paper web 1 is pulled out over additional guide rollers by an intermittent main traction device 5, in the respective set length, and is fed, over stationary guide rollers 6 and 7, to the paper equalizing carriage 8. Paper web 1 runs over lower roll 9 of equalizing carriage 8, then over stationary guide rollers 10 and 11, and then to the two printing mechanisms 12 and 13.

Printing mechanisms 12 and 13 are illustrated as offset printing mechanisms, and are identical in design. Each has a plate cylinder 14, 14', a transfer cylinder 15, 15' and an impression cylinder 16, 16'. Printing plates 17, 17', shown in FIG. 2, are clamped, in a known manner, on the respective plate cylinders 14, 14', and are arranged on the circumference of the associated plate cylinder which latter performs a continuous rotating movement. Each printing plate is inked by an inking device, which has not been shown, and transfers its printing picture, in offset printing, to the rubber coat of the associated transfer cylinder. Opposite the

respective transfer cylinders 15 and 15', there are arranged the impression cylinders 16 and 16' which have, on their circumferences, respective recesses, 18, 18'. All three cylinders 14, 15, 16 and 14', 15' and 16' are rotated. Paper web 1 runs from guide rollers 11 between the transfer and impression cylinders of the two printing mechanisms 12 and 13, and thence to the two upper guide rollers 19 and 20. After leaving guide roller 20, web 1 passes around guide roller 21 and is looped under the upper roll 9a of equalizing carriage 8, after which the paper web passes over guide roller 22 and through the main traction device 5.

Main traction device 5 comprises a main traction roll 23 and two pressure rolls 24 and 25. The paper web arriving from supply loop 4 runs around pressure roll 24 to guide roller 6. The printed paper web arriving from guide roller 22 runs between main traction roll 23 and pressure roll 25 in the direction of the arrow 46 and arrives in a perforator 26 arranged behind main traction device 5, in the direction of paper movement. Perforator 26 is provided with a perforating knife 27 which produces the transversely extending lines of perforation 28, as shown in FIG. 3.

As close as possible behind the two printing mechanisms, as seen in the direction of motion, there is arranged a scanning head 29, with two eyes 30, of known design. The scanning heads are commercial types and are therefore not described in detail, and such scanning heads generally work in connection with electronic building blocks. The electronic control device 31 is connected to scanning head 29 by a multiple-control line 32, and is in turn electrically connected by a multiple-control line 33 to a step motor 34, also of known design. The function of this step motor will be described below with reference to FIGS. 6 and 7.

In the embodiment of the invention shown in FIG. 2, the two adjusting marks, or printing means for printing the adjusting marks, illustrated at 35 and 36, are arranged on the printing plate 17' of second printing mechanism 13, while printing plate 17 of printing mechanism 12 does not have any longitudinal print adjusting marks. The adjusting marks are etched into printing plate 17' together with the printing picture, and define exactly the form length to be printed, the adjusting marks coinciding later with the transversely extending lines of perforations 28. The adjusting marks are linear and are arranged to extend in the same direction and in respective planes 37 and 38 having different respective distances from edge 39 of paper web 1, which is also referred to hereinafter as "the printing material."

FIGS. 4 and 5 illustrate another embodiment of the printing means for printing the adjusting mark. In FIGS. 4 and 5, the printing adjusting marks 35' and 36' are arranged on respective adjusting rings 40 and 41 of plate cylinder 14'. Outer adjusting ring 40 is non-rotatably secured by a key to shaft 42 which, in turn, is keyed to plate cylinder 14'. The inner or second adjusting ring 41 is rotatable or angularly adjustable to a limited extent by virtue of a slot 43 formed therein. Locking of the second rotary adjusting ring is effected by a clamping screw 44.

The adjusting marks printed on paper web 1 by the printing adjusting means are designated 35a and 36a in FIG. 3. Printed adjusting mark 35a is aligned in the plane 37, and printed adjusting mark 36a is aligned in

the plane 38. Each eye 30 of scanning head 29 is aligned with a respective plane 37 or 38.

For the initial position of the form, the end stop 45, shown in FIG. 6, is set to the form length by means of numerical setting values fed into an electronic control device 31, to start the step motor 34. The standard measure for the form length is the distance between the printing adjusting marks 35 and 36 or the printed adjusting marks 35' and 36'. If the position of the end stop is correct in the first setting of the form length, the printed adjusting marks are side-by-side, in coincident position, in the planes 37 and 38. Namely, the mark at the leading edge of a succeeding form coincides longitudinally in lateral alignment with the mark at the trailing edge of a preceding form. In order to illustrate this more clearly, the mark at the leading edge of the first form is designated 35a in the direction of motion indicated in FIG. 3 by the arrow 46. The mark at the trailing end or edge of the first form is designated 36a, while the mark at the leading edge of the immediately following form or sheet is indicated at 35a' with the mark at the trailing edge of the immediately following sheet being indicated at 36a', and so forth. FIG. 3 clearly illustrates the juxtaposition or coincidence of the printed adjusting marks 35a' and 36 and, in the second comparison, the juxtaposition or coincidence of the printed adjusting marks 36a' and 35a².

However, when the exact coincident position of the printed adjusting marks no longer exists during the run of the rotary printing press, and a position difference between the adjusting marks is determined by scanning head 29, the regulating process is started automatically by adjusting end stop 45.

FIG. 6 illustrates one embodiment of the main traction device with an end stop. End stop 45 is arranged inside the main traction device on an adjusting nut 47 which has a female thread 48. A hydraulic cylinder 49 has a male thread 50 engaged with the female thread of adjusting nut 47. In cylinder 49 and in adjusting nut 47, there is guided a plunger 51 which has a counter-stop 52 and, in order to form the counter-stop, plunger 51 is offset to a smaller diameter. Plunger 51 carries a piston 53 with gaskets 54. A pressure medium from a pressure source, which has not been shown, is supplied to the cylinder chamber 55 through a pipeline 56. At its front end, plunger 51 carries a scanning roller 57 which is engageable with the circumferential cam surface of a cam 58 which is arranged on a shaft 59 which is constantly rotated.

On the same shaft, there is also arranged a second cam 60 for driving paper equalizing carriage 8, shown in FIG. 1. This drive is effected through a double rack and pinion drive generally designated at 61. As the drive of the paper equalizing carriage does not form part of the invention, it consequently is not described in detail.

Plunger 51 effects its driving of the traction device through a rack 62 meshing with a pinion 63 keyed, together with a gear 64, on a shaft 65. Gear 64 meshes with a gear 66 keyed to the shaft 67 of main traction roll 23. Also keyed to shaft 67 is the body of shifting coupling 68 which is connected to main traction roll 23 and which entrains the latter when the coupling is engaged. Main traction roll 23 is also connected to a brake coupling 69 whose coupling body is connected, by screws 70, with frame wall 71.

For the alternate engagement and disengagement of the shifting coupling 68 and the brake coupling 69, there are provided a contact ring 72, on shaft 59, and contacts 73' and 73² which cooperate with a contact-free switch 74 whose control line 75 is connected to electronic control device 31.

Cam 58 has a highest curve point 76 from which the circumferential surface of the cam drops in both directions. Cam 58, indicated by solid lines, is in its lowest position, in which scanning roller 57 is disengaged and end stop 52 is effective. In the position represented by broken lines, cam 58 is in its highest position in which plunger 51 assumes its rear end position which is, at the same time, the starting position for the form setting. This starting position of plunger 51 corresponds to the position of printing adjusting mark 35 and of the printed adjusting mark 35a.

The initial setting, and the resetting, of the end stop are effected by electric motor 34 which preferably is designed as a step motor but which can also be an adjusting motor. Motor 34 is operatively connected, through a worm-worm gear 77, shaft 78 and gear 79, with adjusting nut 47 whose outer toothing 80 meshes with gear 79. The shifting of adjusting nut 47, for setting or resetting the end stop, is effected when plunger 51 is relieved, that is, when it does not bear against cam 58. End stop 45 determines the end of the form length, and thus also the moment when scanning roller 57 disengages cam 58. By shifting the end stop, the coincident position of the printed adjusting marks is regulated, and the exact form length 81 (FIG. 3) of the endless forms during the run of the rotary printing press thus also is maintained.

In the embodiment of the invention shown in FIGS. 8 through 14, those parts which have already been shown and described with respect to FIGS. 1 through 7 have been designated by the same reference characters. Consequently, it is believed not necessary to repeat the description of these parts.

In the embodiment of the invention shown in FIGS. 1 through 7, coincidence between the printed adjusting marks is produced by the dual scanning head 29 in cooperation with the electronic control device 31 connected to scanning head 29 by control line 32 and, by an additional control line 33, to step motor 34 of main traction device 5. The arrangement described with respect to FIGS. 1 through 7 adjusts the coincident position of the printed adjusting marks of successive form lengths with respect to the perforation to be produced, and also determines the position of the transversely extending perforation lines 28, coinciding with the printed adjusting marks, by adjusting perforating device 26.

As best seen in FIG. 8, perforating device 26 is driven from the constantly rotating shaft 59 of main traction device 5. For this purpose, a gear 100 secured on shaft 59 constantly meshes with a counter-gear 101 secured on a shaft 102 which drives cutter cylinder 103 of perforating device 26 in a ratio of 1:1 to main traction device 5. This assures that cutter cylinder 103 performs one complete revolution while main traction device 5 performs a working stroke in the direction of traction of paper web 1. Consequently, cutter cylinder 103 is provided with a single knife 27 as a perforating tool. The opposing cylinder 104 has a hard or rigid counter-support 27a in-phase with perforating knife 27, and both are in cooperating relation only during the perforation.

Counter-cylinder 104 is driven in synchronism with cutter cylinder 103 in a ratio of 1:1.

Web 1, passing through perforating device 26, is under the tractive force of two feed rollers 105, 106 of which lower feed roller 105 is driven in synchronism from main traction roll 23 by toothed belt 107. Main traction roll 23 and feed roll 105 have the same dimensions. Upper feed roll 106 is driven by lower feed roll 105 and has the same dimension as pressure cylinder 25 of main traction device 5. The circumferential speeds of feed rolls 105 and 106 are thus the same, and the rate of feed is the same as that of main traction device 5.

Perforating device 26 is associated with a length register 108 which is known per se. Register 108 has an adjusting motor 109 which preferably is a step motor, and which drives a threaded spindle 111 through a reduction gear 110. Register roll 112 is mounted, for free rotation, in bearing blocks 113 which, in turn, have a nut thread 114 engaged with the thread of spindle 111. Bearing blocks 113 have guides engaging counter-guides 116 fixedly secured on frame posts 117. The two spindles 111 are in driving connection with each other through the medium of an intermediate shaft 118 and bevel gears 119, 120, and are driven in a ratio of 1:1. Register roll 112 performs a corresponding ascending and descending movement in the direction of the double arrow 121 shown in FIG. 13.

Paper web 1 forms a loop extending through one half the periphery of register roll 112, and is led over guide rollers 122 and 123. The loop thus formed is determinant for the setting of the adjusting marks to the perforating tool.

Adjusting motor 109 of length register 108 is connected by a control line 124 with electronic control device 31 of main traction device 5. Assuming that adjusting motor 34 and adjusting motor 109 are identical in design and perform the same adjusting path under control pulses, the length register 108 is adjusted in the same direction and by the same amount in an adjustment of main traction device 5. Corrections regarding the coincident setting of adjusting marks 35a and 36a effect the same correction in main traction device 5 and in length register 108.

The fine correction is effected by two additional scanning heads 125 and 126 of the perforating device, of which the first scanning head 125 is directed toward adjusting marks 35a of paper web 1 and the second scanning head 126 to a marking 127 associated with the perforating tool. Both scanning heads are connected by means of control lines 128, 129 and 130, through an electronic control device 131, with adjusting motor 109. In electronic control device 131, the actual-nominal comparison is effected between adjusting mark 35a, or 36a, respectively, and the position of the perforating tool. If the coincidence of the two is not complete, paper web 1, carrying the adjusting mark, is readjusted and the coincidence between the adjusting mark and the perforation 28 is thus restored. In the embodiment of the invention shown in FIG. 10, scanning head 126 is positioned above perforating roll 103 whose perforating knife 27 forms, at the same time, the marking 127.

In the embodiment shown in FIGS. 11 and 12, marking 127 is provided on an adjusting ring 132 which can be locked, in adjusted position, by clamping screws 133.

Instead of the rotating perforating device provided with rolls and knives, there can also be used a punching perforating device as shown in FIG. 14, in which identical or identically acting parts are provided with the same reference numbers. The punch-type perforating device is generally designated 26a. Knife 27 performs an ascending or descending movement which is actuated by a bell crank 134 swinging about the fixed pivot 135. Bell crank 134 is connected to a pushrod 136 which carries, at its free end, a freely rotating scanning roller 137 runs on the circumference of a cam disc 138 which either carries on itself the marking or which has secured thereto an adjusting ring 132 with the marking, as shown in FIG. 14 in broken lines. Scanning head 126 is directed toward this marking 127, and cam disc 138 makes one revolution for each form length. The time of operation of the punching tool for producing a perforation 28, and the time of scanning of marking 127 by scanning head 126, are in-phase. The perforation is effected at the time of standstill of paper web 1, and is thus in coincidence with main traction device 5 which effects the temporary stoppage of the paper web. The fixed support opposite and cooperating with knife 27 is designated 27a as also in FIG. 8.

FIG. 8 also shows, adjoining perforating device 26, additional working stations 139 and 140 which either produce additional transversely extending perforation lines or which can effect punchings or impressions. Stations 139 and 140, if provided, run in synchronism with perforating device 26, so that they would thus be in driving connection with the latter. Their control thus is effected indirectly in the same manner by adjusting marks 35a and 36a.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. In a rotary printing press for printing variable length forms of printing material, particularly endless webs of forms having transversely extending lines of perforations, with printing mechanisms including plate cylinders carrying plates extending through part of their circumferential peripheries and effecting intermittent printings of successive forms, a main traction device drawing a web from a supply roll thereof and feeding the web to the printing mechanisms between intermittent successive printings of forms by the latter, the traction device having a web feeding stroke adjustable in accordance with the form length and including a main traction roll means for adjustably rotating said roll intermittently in the direction of movement of the web through a peripheral distance equal to the length of the web feeding stroke and cooperable with pressure rolls to advance the web a distance equal to the length of the web feeding stroke, a reciprocable equalizing carriage between the traction device and the printing mechanisms, having rolls looped by the web, and means for reciprocating the carriage to change the length of the looped web to compensate for the difference between the intermittent advance of the web by the traction device and the intermittent printings of forms by the printing mechanism, and perforating means operable to form lines of perforations extending transversely of the web between adjacent forms: the

improvement comprising, in combination, means on the leading and trailing ends of each plate on said plate cylinders operable to print adjusting marks, on the printing material web, at the leading and trailing ends of each form length; scanning means positioned, in the direction of movement of the printing material, directly behind said printing mechanisms and operable to scan said printed adjusting marks to detect any lack of longitudinal coincidence between the mark at the trailing end of each form and the mark at the leading end of the respective next succeeding form; said means for adjustably rotating said roll including an adjusting motor connected to said main traction device and operable to adjust the web feeding stroke thereof; and control means connecting said scanning means in controlling relation with said adjusting motor to effect operation of said adjusting motor in accordance with the scanned printed adjusting marks to regulate the web feeding stroke of said traction device to maintain coincidence between the printed adjusting mark at the trailing end of each form and the printed adjusting mark at the leading end of the respective next succeeding form.

2. In a rotary printing press for variable length forms of printing material, as claimed in claim 1, in which said means operable to print said adjusting marks prints adjusting marks which are linear and extend in the same direction, with the adjusting marks on each form arranged in respective planes which are at respective different spacings from an edge of the printing material web and with all of the adjusting marks at the leading ends of the forms being aligned in one of said planes and all of the adjusting marks at the trailing ends of the forms being aligned in the other plane.

3. In a rotary printing press for variable length forms of printing material, as claimed in claim 1, in which the means operable to print said adjusting marks are arranged on one of said printing plates.

4. In a rotary printing press for variable length forms of printing material, as claimed in claim 1, including a pair of adjusting rings, means to lock said pair of adjusting rings in a registered position in relation to the form to be printed, at one end of one of said plate cylinders; said means operable to print adjusting marks being arranged on respective adjusting rings.

5. In a rotary printing press for variable length forms of printing material, as claimed in claim 1, in which said main traction device has an end stop adjustable by said adjusting motor; said adjusting motor comprising a step motor operable to adjust said end stop to the form length; said end stop being arranged on an internally threaded adjusting nut threadedly engaged by an externally threaded fluid pressure cylinder; a plunger secured to a piston engaged in said cylinder; a counter-stop on said plunger engageable with said end stop; a cam having a curvilinear periphery engageable with one end of said plunger; and means continuously driving said cam; said one end of said plunger engaging said cam between the highest point of its curvilinear periphery and the end point of the dropping curve leg of said cam as determined by the adjustment of said end stop.

6. In a rotary printing press for variable length forms of printing material, as claimed in claim 5, in which the opposite end of said plunger is formed as a rack; a pinion engaged with said rack; gears connecting said pinion with a main traction shaft of said main traction device; a disengageable coupling interposed between said

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gears and said main traction shaft; and a disengageable brake coupling connected to said main traction shaft; said first-mentioned disengageable coupling and said brake coupling being engaged and disengaged in alternation with each other.

7. In a rotary printing press for variable length forms of printing material, as claimed in claim 5, including a self-locking worm-worm gear drive connecting said nut with said step motor.

8. In a rotary printing press for variable length forms of printing material, as claimed in claim 5, including means operable to feed setting values to said step motor to preadjust said end stop to set the initial form length.

9. In a rotary printing press for variable forms of printing material, as claimed in claim 1, including web length adjusting means between said printing mechanisms and said perforating means operable by said control means, to adjust the length of the web between said printing mechanisms and said perforating means in a direction such that said perforating means operates to form a line of perforations extending transversely of the printing material in coincidence with said printed adjusting marks.

10. In a rotary printing press for variable length forms of printing material, as claimed in claim 1, including a length register guiding said printing material web between said main traction device and said perforating means; and means connecting said length register to said control means and operable to adjust said length register, simultaneously and in synchronism with said main traction device, by the same amount and in the same direction as the web feeding stroke of said main traction device is adjusted.

11. In a rotary printing press for variable length forms of printing material, as claimed in claim 10, in which said length register includes a second adjusting motor; an electronic control device; first and second additional scanning heads operatively associated with said perforating means; said first scanning head scanning

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one set of adjusting marks on the printing material; said second scanning head scanning a marking associated with the perforating tool of said perforating means; additional control lines connecting both scanning heads to said second adjusting motor through said electronic control device to regulate the printing material to the coincident position of said printed adjusting marks and said marking associated with said perforating tool.

12. In a rotary printing press for variable length forms of printing material, as claimed in claim 11, in which said perforating means comprises a perforating device actuated by a bell crank and provided with punching knives; and a rotatable cam disc operable to actuate said bell crank; said cam disc carrying said marking associated with said perforating tool.

13. In a rotary printing press for variable length forms of printing material, as claimed in claim 12, including an adjusting ring arranged on said cam disc and carrying said marking associated with said perforating tool.

14. In a rotary printing press for variable length forms of printing material, as claimed in claim 10, in which said perforating means is a rotating perforating device having rolls and knives; said marking associated with the perforating tool being aligned with a perforating knife and arranged on the perforating roll carrying said perforating knife.

15. In a rotary printing press for variable length forms of printing material, as claimed in claim 14, including an adjusting ring, means to lock said adjusting ring in a registered position in relation to the form to be printed, at an end of said perforating roll; said adjusting ring carrying said marking associated with the perforating tool.

16. In a rotary printing press for variable length forms of printing material, as claimed in claim 14, in which the edge of a perforating knife constitutes said marking associated with said perforating tool.

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