June 2, 1970 R. R. SMITH, JR 3,515,328

CONTROLLED WEB LENGTH IN-FEED FOR ROTARY PRINTING PRESS

Filed Jan. 29, 1968 2 Sheets-Sheet 1

Fig. 1.

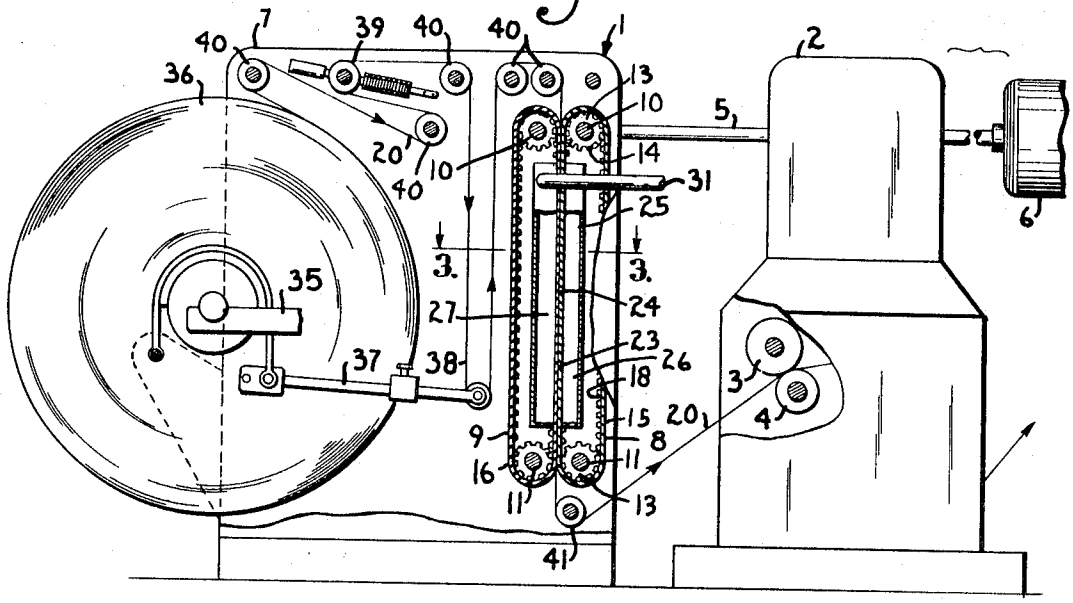

Fig. 2.

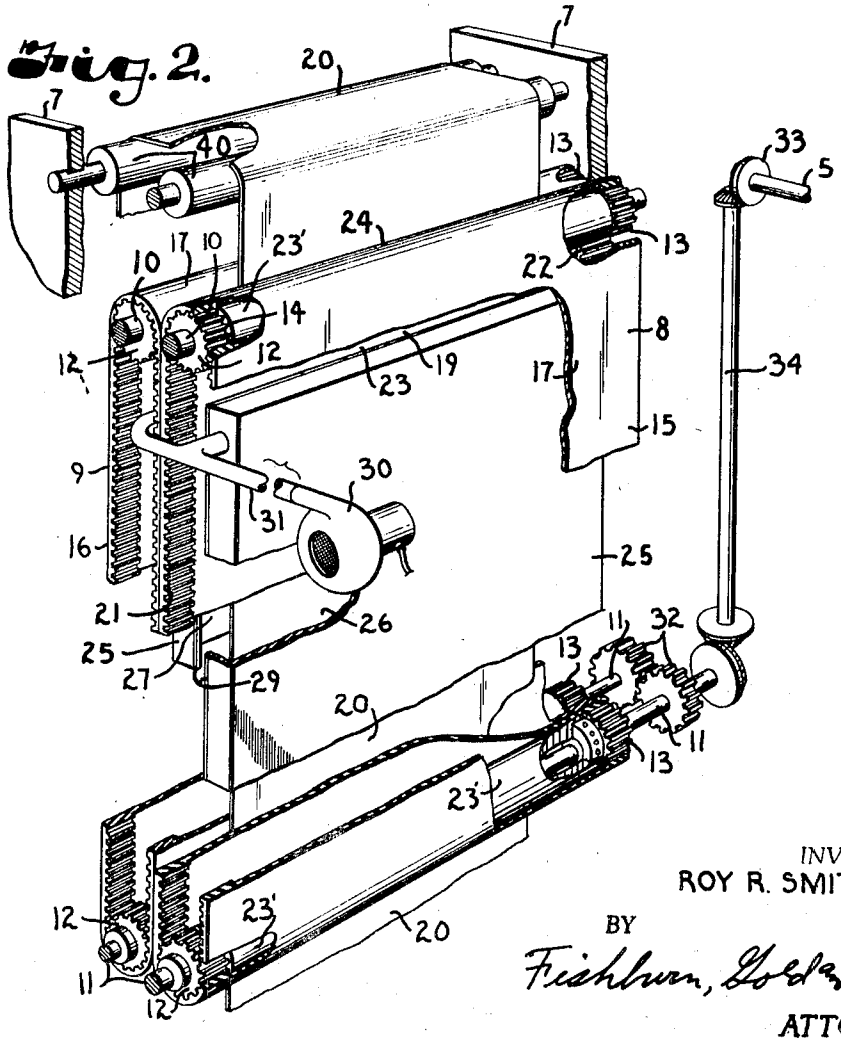

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Fig. 3.

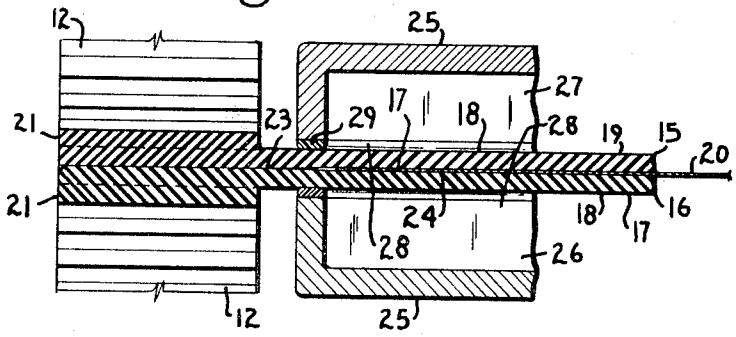


Fig. 4.

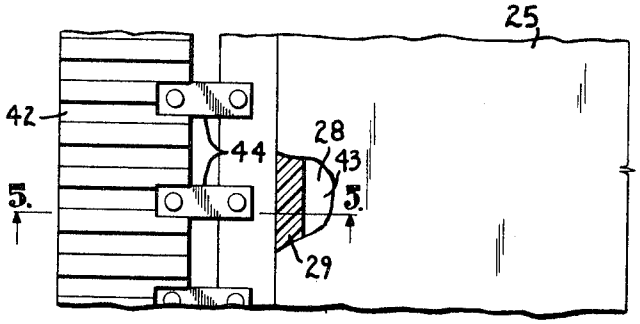


Fig. 5.

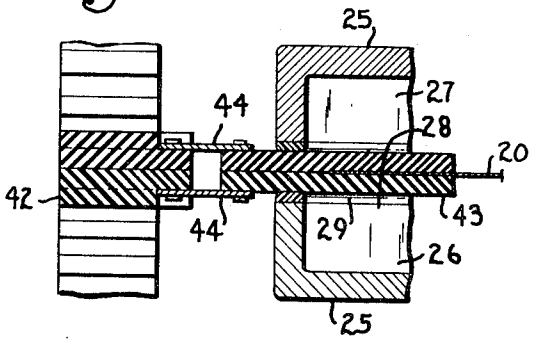


Fig. 6.

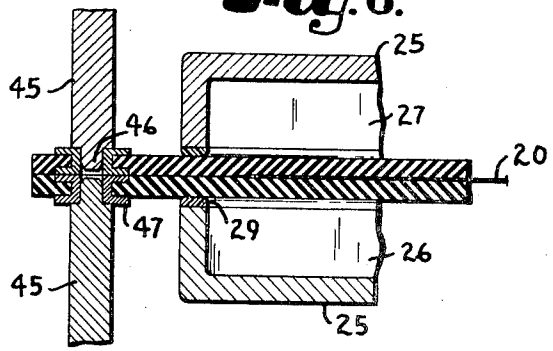
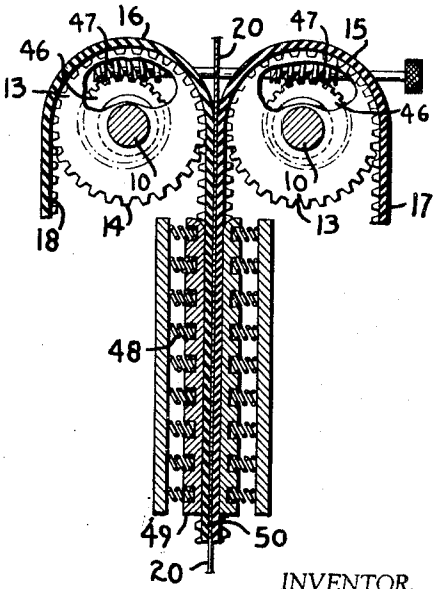


Fig. 7.



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CONTROLLED WEB LENGTH IN-FEED FOR ROTARY PRINTING PRESS

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Int. Cl. B65h 17/24
U.S. Cl. 226—172 6 Claims

ABSTRACT OF THE DISCLOSURE

A web in-feeding device for a rotary printing press includes a pair of drive assemblies having opposed adjacent endless belts urged together along a run to form an extensive web gripping bight therebetween, the belts being driven by the press drive so as to maintain synchronization with the press.

This invention relates to web handling apparatus and more particularly to a paper web in-feeding device for rotary printing presses and the like.

Rotary web printing presses are designed to transfer a predetermined length of web therethrough for each printing cycle or revolution of the printing cylinder. This web length, however, is not absolutely constant, but varies slightly due to changing conditions of operation. For example, the effective driving diameter of a press cylinder about which the web is partially wrapped is altered when a web of different thickness is used, varying the length of web delivered per revolution. Further, variations in paper type, web tension, printing cylinder pressure on the web, etc., have often unpredictable effects which tend to result in slight but cumulative errors in rerolled printed webs.

In multiple copy business form production, high uniformity of web length per printing cylinder revolution becomes extremely important because many separately printed and rerolled webs must be collated into exact register to form the finished product. Significant variations occur in paper of the same weight, and even within a single mill roll, causing length control difficulties, however, the overall problem is compounded due to the common use of a number of different weights and types of paper web for a single form set. Heretofore an experienced press operator, through the careful and frequent use of manually adjustable in-feed devices, could produce acceptable collated business forms, but at high labor expense, extended set-up periods, low production speeds and often considerable waste.

One solution for overcoming the above problems has been disclosed in U.S. Pat. No. 3,264,984, issued Aug. 9 1966, wherein a free turning wheel is maintained in contact with the web, the rotation of the wheel being monitored and compared with the rotation of the printing cylinders, relative variations in the rotations being used to produce a signal for controlling a variable transmission drive operating web releasing grip means. This solution requires relatively complex and, therefore, expensive apparatus.

This invention contemplates a relatively simple web in-feeding device adapted to provide accurate web length control. Briefly, this invention comprises a pair of endless belts driven in synchronization with the rotation of the printing cylinders and with a considerable portion of the outer surfaces thereof in a face-to-face run, forming an extensive bight therebetween travelling at the surface speed of the printing cylinders, which grips and delivers the web into the press. The device is insensitive to variations in paper thickness, grips the web firmly due to high total pressure over a large area and yet produces low,

even unit pressure thereon, substantially avoiding the distortion of web structure.

The principal objects of the present invention are: to provide a novel in-feeding device which releases a predetermined length of web into a rotary printing press per printing cylinder revolution regardless of changing press demand therefor and to provide such a device of minimum complexity and cost which is particularly adapted for high speed, high quality business form production.

Other objects and advantages in this invention will become apparent from the following description taken in connection with the accompanying drawings wherein are set forth by way of illustration and example certain embodiments of this invention.

FIG. 1 is a partially schematic side elevation, with portions broken away, illustrating a web in-feeding device embodying this invention and located in operative relation between a mill roll and a typical rotary printing press tower or head.

FIG. 2 is a partially schematic fragmentary perspective view particularly showing the web in-feeding device and related structure.

FIG. 3 is a fragmentary cross-sectional view on an enlarged scale taken on the line 3—3, FIG. 1 showing feeding belts at the bight.

FIG. 4 is a fragmentary plan view showing a modified form of belt construction.

FIG. 5 is a fragmentary cross-sectional view on an enlarged scale taken on the line 5—5, FIG. 4 showing the modified belt construction in greater detail with related parts.

FIG. 6 is a fragmentary cross-sectional view similar to FIGS. 3 and 5 but showing a further modified form of belt construction.

FIG. 7 is a fragmentary cross-sectional view showing a modified form of structure for urging the belts together.

Referring to the drawings in more detail:

The reference numeral 1 generally indicates a web in-feeding device embodying this invention. The device 1 is shown cooperating with a web receiving apparatus in the form of a printing tower 2 of any conventional type having printing cylinders 3 and impression cylinders 4 constituting web pull-in members and a power input shaft 5 by which the cylinders 3 and 4 are driven through a suitable rotary power source 6.

The in-feeding device 1 comprises a suitable rigid frame 7 having a pair of drive assemblies 8 and 9 mounted thereon. The drive assemblies 8 and 9 each include first and second laterally spaced-apart parallel shafts 10 and 11 and first and second axially separated drive wheels 12 and 13 mounted on each of the shafts 10 and 11 and in radial alignment with the corresponding drive wheels on the other shaft. In this example, the drive wheels 12 and 13 take the form of cog wheels or gears, having circumferentially spaced cogs or gear teeth 14 therearound.

Respective endless belts 15 and 16 form part of the assemblies 8 and 9 and each has an outside surface 17 and an inside surface 18. The belts 15 and 16 are of considerable lateral width and include a central portion 19 with a width greater than the width of the web 20 handled by the in-feeding device 1. The endless belts 15 and 16 includes side drive portions 21 and 22 on opposite lateral edges of the central portion 19 and spaced apart the distance of the drive wheel axial separation. The side drive wheel portions 21 and 22 respectively are positively engaged with the drive wheels 12 and 13 and the shafts 10 and 11 of the respective drive assemblies are spaced apart whereby the belt outside surfaces 17 are drawn relatively tight, forming portions 23 which are main-

tained in planar runs. In this example, central portions **19** of the belts **15** and **16** are supported between the drive wheels **12** and **13** by elongated free running rollers **23'** mounted on the shafts **10** and **11** and having outside surfaces extending in contact with the inside surfaces **18**. The drive assemblies **8** and **9** are located with respect to each other on the frame **7** whereby the portions **23**, or planar runs, are in face-to-face relation forming an extensive planar bight **24** therebetween.

A plurality of connected walls **25** are located within the closed loops described by the wheel mounted belts **15** and **16** and form respective chambers **26** and **27** having open sides or openings **28** directed toward the inside surface **18** of the respective belts **15** and **16** at the planar run portions **23**. Lips **29** of nylon or other suitable low friction material are mounted on the wall edges surrounding the openings **28** and are maintained substantially in sliding contact with the inside surfaces **18** whereby the openings **28** are closed by the belts **15** and **16** without interference with the free movement thereof through the planar run portions **23**.

A suitable air pump or fan **30** communicates into the respective chambers **26** and **27** through manifold piping **31** and is adapted to supply air at above atmospheric pressure into the chambers **26** and **27** for urging the belts toward each other at the planar run portions **23**, thus producing relatively high face-to-face pressure at the bight **24**.

In this example the upper shafts **10** are rotatably carried by the frame **7** on adjustable bearings described below and the shafts **11** are rotatably carried by the frame **7** on fixed axes. The drive wheels **12** and **13** on the shafts **11** are rotatably fixed thereto with spur gears **32** mounted on lateral extensions of the shafts **11**. The gears **32** are engaged with each other to maintain positive synchronization of movement between the belts at the bight **24**. The power input shaft **5** operably extends longitudinally past the printing tower **2**, and in this example, terminates in a bevel gear **33** which cooperates with a bevel geared power transmission train **34** engaging one of the shafts **11** whereby operation of the power source **6** synchronously drives the printing tower **2** and the belts **15** and **16**.

The frame **7**, in this example, includes shaft receiving structure **35** adapted to rotatably support a conventional paper mill roll **36** for paying out the web **20**. The roll **36** is retarded against uneven pay-out and a relatively constant tension is maintained on the unwinding web **20** by means of a conventional drag brake **37** operated through a depending loop **38** in the web, however, other known constant tension devices may be used singly or in combination if desired. A spring-urged roller **39** is resiliently mounted at opposite ends thereof on suitable structure within the frame **7** to smooth out undesirable local tension spots in the web, for example, caused by a lop-sided roll **36**. Suitable web direction changing rollers **40** are rotatably mounted on the frame **7** in locations for efficiently guiding the web **20** over the spring-urged roller **39**, into loop **38** and into the bight **24**. An exit roller **41** receives the web **20** from the bight **24** and directs it into the printing tower **2** where it is received by the web pull-in members, in this case the printing and impression cylinders **3** and **4**.

In operation, the outside surface speed of the belts through the bight **24** is matched, through gear selection, to the surface speed of the printing cylinder **3**, however, a small difference is maintained whereby the printing tower overdrives with respect to the bight very slightly on the lightest web to be used. Thus, the web is always maintained in a tight condition. The positive drive between the printing tower and belts **15** and **16** precludes any loss of synchronization and the planar run of the web through the bight **24** substantially eliminates any error which would otherwise be introduced due to varying web thickness. Slippage of the web with respect to the bight is practically non-existent since pressure over a considerable web area is continually maintained in the bight by the pressure in the chambers **26** and **27**, yet web structure distortion is substantially avoided.

It is noted that, although the ideal conditions for the practice of this invention require a true planar run through the bight, a slight curve may appear in the bight without introducing significant error in web delivery caused by variations in web thickness. The invention should, therefore, not be limited strictly to a true planar bight.

Referring to FIGS. 4 and 5, a modified belt construction is illustrated wherein the side drive portions **42** take the form of conventional timing belts and the central portion **43** is connected to the side drive portions by suitable spaced lugs **44** projecting therebetween and respectively riveted thereto.

FIG. 6 illustrates a further modified form of this invention wherein the drive wheels **45** take the form of sprocket wheels having teeth **46** which are received in hollow metal rivets **47** spaced along the side-drive portions of the belts.

FIG. 7 illustrates a still further modified form of this invention which utilizes springs **48** urged against suitable semi-rigid pressure plates **49** which are maintained in sliding contact with the inside surfaces **50** of the belts, instead of the air pressure system described in connection with FIG. 2.

The belts, being inherently slightly flexible, are produced with the outside surfaces **17** slightly less in running length than required and the required length for proper web length delivery is achieved, in this example, by a slight stretching produced by adjustably separating the shafts **10** and **11**. The adjustment may be accomplished, for example, by using eccentrically bored bearing supports **46** for the shafts **10**, the supports **46** being rotatable on an axis displaced from the shaft axis by worms **47**, FIG. 7.

What I claim and desire to secure by Letters Patent is:

1. A web in-feeding device for use with web receiving apparatus having a power input shaft driving web pull-in members, said in-feeding device comprising:

(a) a frame, a pair of drive assemblies mounted on said frame and each including an endless belt movably supported thereon to form planar lengths, said drive assemblies being positioned whereby said lengths are in face-to-face relation forming a substantially planar bight position to receive the web therebetween,

(b) means engaging said belts for urging said belts together at said bight, and

(c) means operably connecting at least one of said drive assemblies to said input shaft for driving said belts at a surface speed through said bight corresponding to the driven speed of said web pull-in members,

(d) at least one of said belts having a side drive portion including positive drive members, and

(e) at least one of said drive assemblies including a drive wheel with positive drive members engaging said side drive portion members.

2. The in-feeding device as set forth in claim **1** wherein said belts comprise:

(a) a central portion having a smooth inside and outside surface, and

(b) said side drive portion has positive drive members on the inside surface thereof.

3. The structure as set forth in claim **2** wherein:

(a) said side drive portion is integral with said central portion.

4. The structure as set forth in claim **2** wherein:

(a) said side drive portion is separate from said central portion, and including

(b) spaced structural members connecting said side drive portions to said central portion.

5. The in-feeding device as set forth in claim 1 wherein said drive assembly includes:

(a) a free roller mounted coaxially with said drive wheel.

6. A web in-feeding device for use with a web receiving apparatus having a power input shaft and web pull-in members, said in-feeding device being adapted to release a predetermined length of web into the apparatus per operating cycle thereof regardless of a changing web demand of the apparatus, said in-feeding device comprising:

(a) a frame, a pair of drive assemblies mounted on said frame, said drive assemblies each including;

(b) first and second laterally spaced-apart parallel shaft members and first and second axially separated positive drive wheels mounted on each of said shaft members and in radial alignment with the corresponding drive wheels on the other shaft member, and an endless belt in each of said assemblies, said endless belt having an outside surface and an inside surface and a central portion, said endless belt having side drive portions spaced apart the distance of said drive wheel axial separation and positively engaging said respective first and second drive wheels on each shaft member whereby a portion of said outside surface is maintained in a planar run,

(c) said drive assemblies being positioned with said respective planar runs in face-to-face relation forming an extensive planar bight portion therebetween,

(d) means urging said belts toward each other at said planar bight,

(e) means operably connecting selected drive wheels of said drive assemblies to maintain synchronization of movement between said belts at said bight, means associated with said frame for supplying a web into said bight and directing the web from said bight into said web receiving apparatus, and

(f) means operably connecting said power input shaft to said drive wheel connecting means for driving said belts with said web receiving apparatus.

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