United States Patent

Smith, Jr.

[15] **3,677,177**

[45] **July 18, 1972**

[54] DRIVE FOR CONTROLLING WEB LENGTH IN ROTARY PRINTING PRESSES

[72] Inventor: **Roy R. Smith, Jr.**, Leawood, Kans.

[73] Assignee: **Smith R.P.M. Corporation**, Kansas City, Mo.

[22] Filed: **July 28, 1970**

[21] Appl. No.: **58,809**

[52] **U.S. Cl.** **101/228**, 226/30

[51] **Int. Cl.** **B41f 13/02**

[58] **Field of Search** ..... 101/228, 227, 224, 225; 74/689, 230.17 A–230.17 E; 318/611; 226/42, 40, 41, 30, 31, 24

[56] **References Cited**

UNITED STATES PATENTS

3,264,984	8/1966	Smith, Jr.	101/178
2,144,307	1/1939	Hallden	74/689 X
2,509,685	5/1950	Hughes	74/689
2,881,639	4/1959	Holtan	74/681
2,267,135	12/1941	Roberts	318/611
2,830,811	4/1958	Paul	74/689

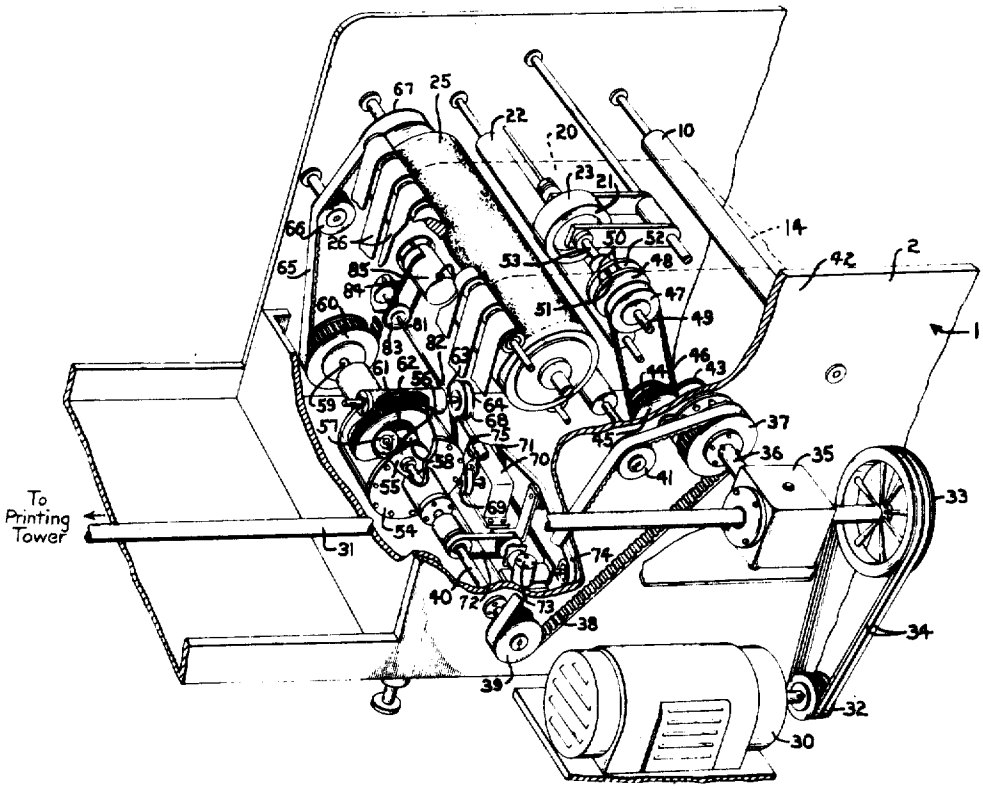
Primary Examiner—J. Reed Fisher

Attorney—Fishburn, Gold & Litman

[57] **ABSTRACT**

A rotary press web infeed includes a differential transmission having a spider assembly rotatable through a variable speed drive controlled by a reversible motor operated by a web length measuring system, providing extremely fine control of paper infeed to the press.

1 Claim, 4 Drawing Figures



Patented July 18, 1972 3,677,177

2 Sheets-Sheet 1

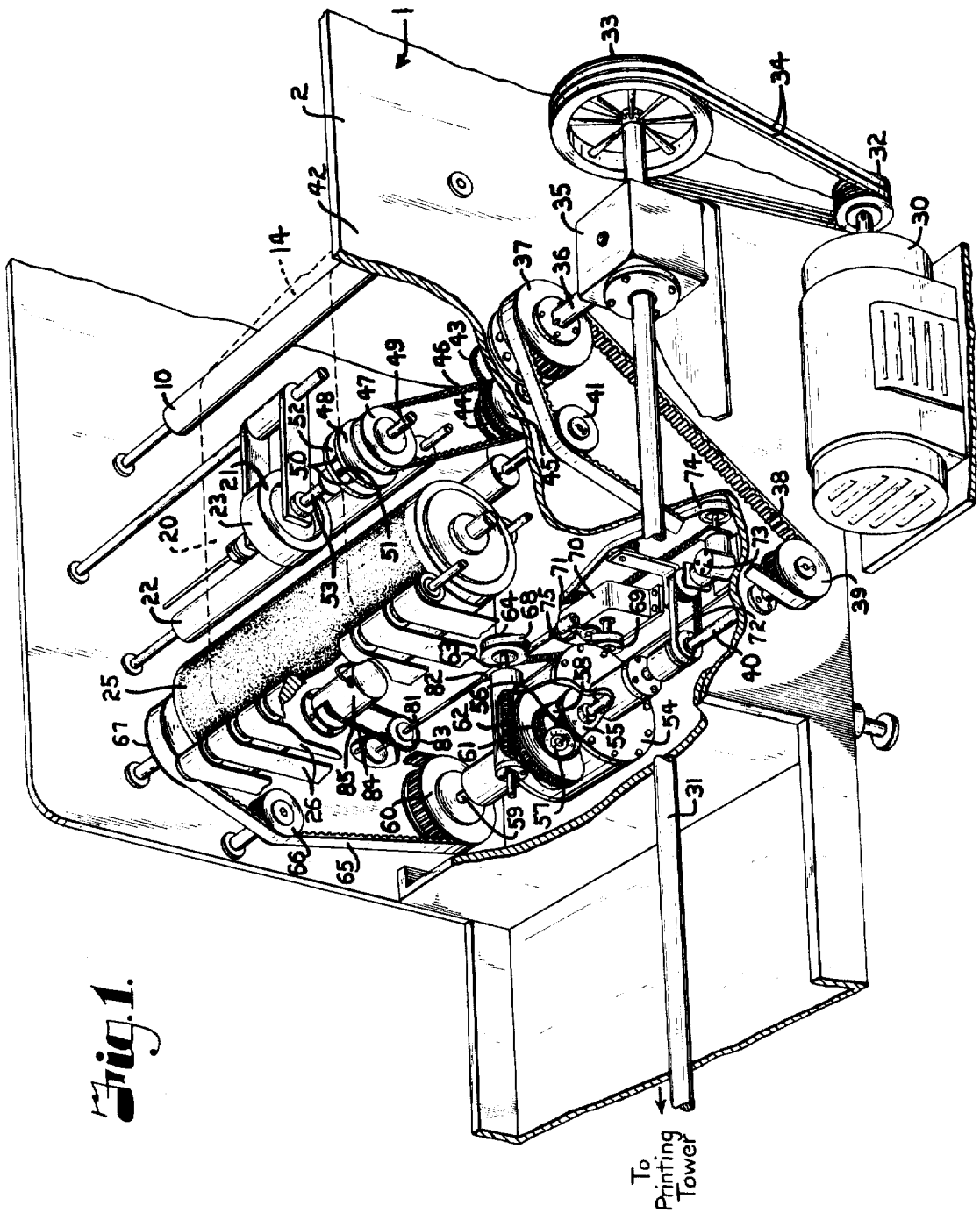


Fig. 1.

INVENTOR.
Roy R. Smith, Jr.
BY
Fishburn, Gold & Litman
ATTORNEYS

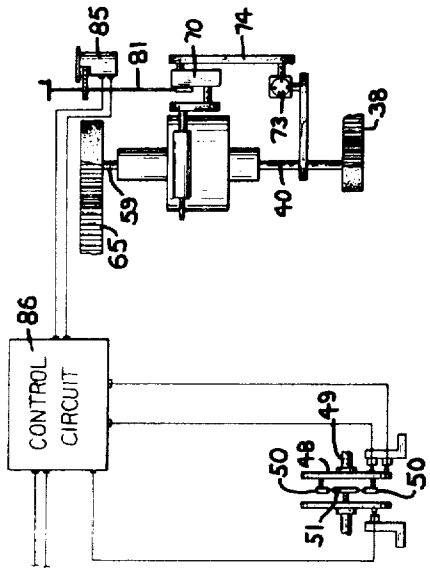


Fig. 3.

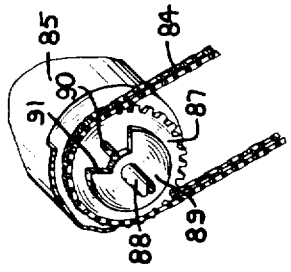


Fig. 4.

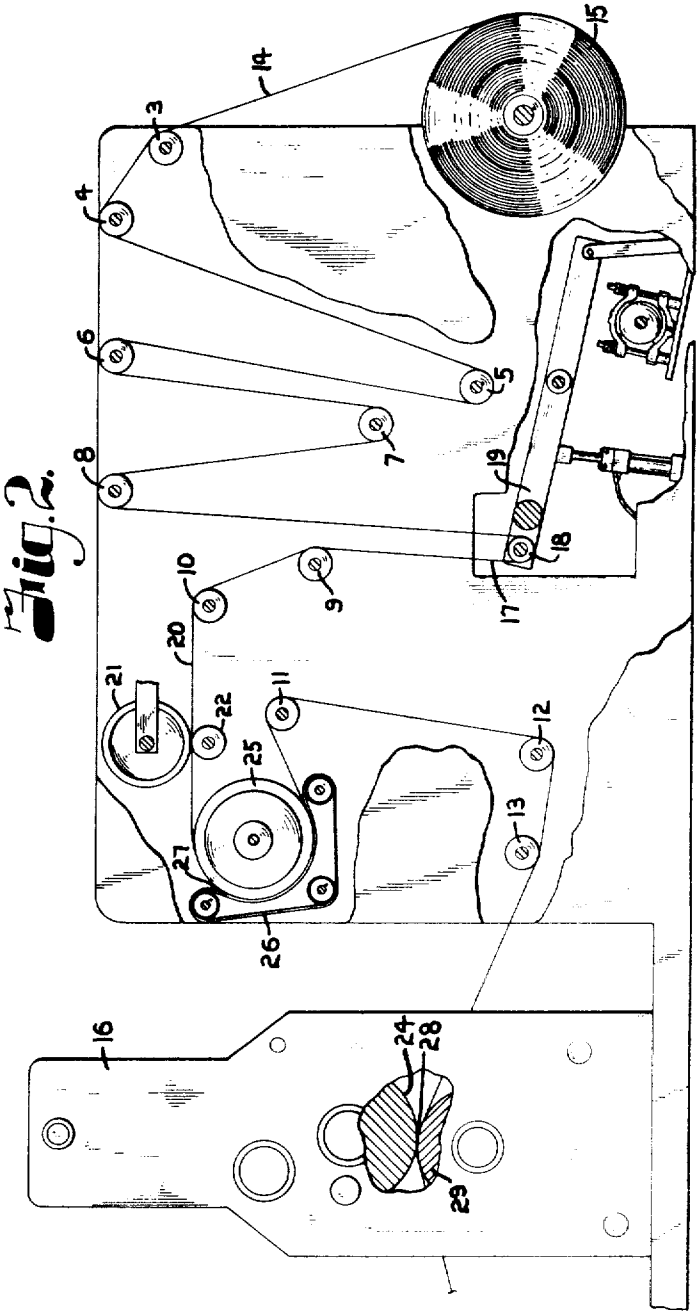


Fig. 2.

INVENTOR.
Roy R. Smith, Jr.
BY
Fishburn, Gold & Litman
ATTORNEYS

DRIVE FOR CONTROLLING WEB LENGTH IN ROTARY PRINTING PRESSES

This invention relates to paper web handling apparatus and more particularly to improvements in web infeeding devices of the type disclosed in U.S. Pat. No. 3,264,984, issued Aug. 9, 1966.

The apparatus described in said U.S. Pat. No. 3,264,984, includes a positive, infinitely variable speed transmission having a reversible motor for varying the rotation ratio between the input and output shaft. Although several types of such transmissions are commercially available and have been found to operate in a generally satisfactory manner, none were found to supply the extreme precision desirable to produce the fine registration desired between several printed webs having high variations in paper thickness, stretchability and surface finish. This invention contemplates the modification of the basic apparatus described in said U.S. Pat. No. 3,264,984, to increase the precision obtainable, thereby reducing the variables which otherwise may combine to produce poor registration between printed webs.

The modification utilizes a differential transmission having a spider assembly rotatable both through normal input-output operation and through a controlled variable speed transmission driven by the input to the differential transmission. The variable speed transmission is controlled through linkage with a reversible motor which is actuated through a web speed sensor and comparator.

The principal objects of the present invention are: to provide a web infeeding device which controls web delivery length with extreme precision; to provide such a device which releases a predetermined standard length of web into a rotary printing press per printing cylinder revolution regardless of demand; to provide such a device which minimizes length variations otherwise caused by variations in the weight or thickness of the web; and to provide such apparatus which is substantially unaffected by changes in press speed.

Other objects and advantages of 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 fragmentary perspective view of the infeed apparatus modified in accordance with this invention, with portions broken away to show the relationship of various parts.

FIG. 2 is a fragmentary side elevational view of the infeed apparatus and a printing tower associated therewith, particularly showing the path of web travel.

FIG. 3 is a schematic view of the apparatus control circuit.

FIG. 4 is a fragmentary perspective view showing details of a reversible control motor forming a portion of the apparatus.

REFERRING TO THE DRAWINGS IN MORE DETAIL

The reference numeral 1 generally indicates a web infeeding device embodying this invention. The device 1 comprises a rigid frame 2 rotatably supporting a plurality of rollers 3 – 13 for guiding the web 14 from a mill roll 15 to a typical printing tower 16. The rollers 4 – 8 guide the web 14 through a zig-zag festooning path for web relaxation following release from a possibly lopsided or unevenly wound condition. The web 14 is then directed into a loop 17 about a roller 18 rotatably mounted between suitable pivoted lever arms 19 which, through suitable control apparatus (not described herein) maintain sufficient unwind drag on the mill roll 15 so as to produce the desired tension at a web length measuring section 20.

A control wheel 21 and an idler roller 22 are positioned in paired running relation forming a control couple adapted to receive and grip the web therebetween in the section 20. As described in greater detail in said U.S. Pat. No. 3,264,984, the control couple formed by the wheel 21 and roller 22 is driven by the motion of the web 14, the control wheel 21 having an outside web-contacting cylindrical surface 23 with an effective circumference proportional to the circumference of the printing cylinder 24 in the printing tower 16.

A cylinder 25 and a plurality of laterally spaced apart, endless belts 26 together form a feed roll couple 27 adapted to grip the web 14 and continuously release it into the printing tower 16. As described in greater detail in co-pending patent application Ser. No. 795,940 the endless belts 26 are maintained in taught driving condition against the feed roll couple cylinder 25 so as to grip the web between the belts and the cylinder surface over a substantial angle. The cylinder 25 is preferably coated with a non-slip surface similar to sand paper to provide a positive gripping action, while the cylinder 25 is rotated at such a rate that an exact length of web per printing cylinder revolution is released into the pull-in couple 28 formed between the printing cylinder 24 and impression cylinder 29. This is accomplished by coordinated driving of the printing tower 16 and feed roll couple cylinder 25 as now described.

A suitable prime mover in the form of an electric motor 30 drives a power input shaft 31 through suitable pulleys 32, 33 and cooperating belts 34. The power input shaft drives the printing tower 16 and, thus, the printing pull-in couple 28 through suitable conventional positive gearing (not shown). The power input shaft 31 is associated with a suitable gear box 35 through which a stub shaft 36 is positively driven in coordination with the power input shaft 31. A timing belt sprocket 37 is secured to the stub shaft 36 and engages a timing belt 38 which, in turn, engages a timing belt sprocket 39 secured to a transmission input shaft 40. The timing belt 38 also engages an idler sprocket 41 which is suitably adjustable to maintain the belt under proper tension for precision operation.

The stub shaft 36 projects through the side wall 42 of the frame 2 and supports a gear 43 in running engagement with a timing gear 44. The gear 44 is mounted on a common shaft with a timing belt sprocket 45 engaging a timing belt 46 which in turn is maintained in running engagement with a timing belt sprocket 47. The timing belt sprocket 47 drives a control disc 48 through a shaft 49. The control disc 48 carries a pair of spaced apart contacts 50 between which is positioned a contact 51 mounted on a control disc 52 which is rotated by a shaft 53 in response to rotation of the control wheel 21 driven by the movement of the web 14. Further details and variations of the above structure are described in the noted U.S. Pat. No. 3,264,984.

A differential transmission 54, for example, of the type known as a line shaft phase shifting transmission and sold by Fairchild Hiller, Winston-Salem, North Carolina, under the trademark SPECON, includes a first differential side gear 55 secured to the transmission input shaft 40. The differential transmission 54 also has a spider assembly 56 with pinions 57 engaged with the first differential side gear 55 and a second differential side gear 58. An output shaft 59 is fastened to the spider assembly 56 whereby the rotation of said spider assembly rotates the output shaft 59 and the timing belt sprocket 60 secured thereto. A worm gear 61 is fixed to the second differential side gear 58 and engages a worm 62 on an adjusting shaft 63 which supports a timing belt sprocket 64. The rotation of the timing belt sprocket 64 results in a much slower rotation of the worm gear 61 which adds or substracts to the output speed of the shaft 59, which normally rotates at one-half the speed of the transmission input shaft 40. A timing belt 65 engages an idler sprocket 66, the timing belt sprocket 60 and a timing belt sprocket 67, the latter being operably engaged with the feed roll couple cylinder 25.

The timing belt sprocket 64 on the adjusting shaft 63 is engaged with a timing belt 68 which is operable engaged with an output sprocket 69 of a mechanical variable speed drive 70. The input sprocket 71 of the variable speed drive 70 is driven by the transmission input shaft 40 through timing belt 72, right angle gear transmission 73 and timing belt 74. Thus, the input speed to the variable speed drive 70 always corresponds proportionally to the input speed to the printing tower 16 and transmission input shaft 40.

The variable speed drive 70 may be of any suitable type, for example, that sold by Zero-Max Industries, Inc., Minneapolis, Minnesota under the trademark ZERO-MAX. The variable

speed drive is controlled by an adjusting lever **75** whereby the rotation ratio between the input sprocket **71** and output sprocket **69** may be varied for adding or substracting a rotational correction to the transmission output shaft **59**. The lever **75** is adjustable in operative position by means of a threaded shaft **81** engaged in an elongated threaded socket **82** in such a manner that the rotation of the shaft **81** produces an alternation in crank position. A sprocket **83** is engaged with the threaded shaft **81** and is operably connected through a chain **84** to a reversible motor **85** controlled by the contacts **50** and **51** in a manner described in detail in said U.S. Pat. No. 3,264,984 through a control circuit **86**, FIG. **3**.

It is to be understood that in its preferred form, the respective sprocket sizes are chosen so that a small correction (rotation of the worm **62**) is continuously fed into the differential transmission **54**. Thus, a speed modification signal received by reversible motor **85** will result in a speeding up or slowing down of the worm **62** rotation rather than a direction reversal. In this manner, errors due to back-lash and the like may be substantially avoided.

As shown in FIG. **4**, the chain **84**, rotating the threaded shaft **81**, is engaged with a sprocket **87**. The sprocket **87** freely rotates upon a shaft **88**, that is, it is not directly fastened to the shaft of the reversible motor **85**. A cam member **89**, however, is secured to the reversible motor shaft **88** and rotates directly therewith. A pin **90** projects outwardly from the sprocket **87** into an angular cut-out area **91** formed in the cam member **89**. Thus, very small corrections, which are reflected in the motor **85** moving the cam member **89** only through a small angle, often do not change the operational position of the speed drive adjusting lever **75**. This reduces the tendency for unwanted feed-back oscillations, however, when a significant correction is called for the cam member **89** contacts the pin **90** thereby causing a rotation of the threaded shaft **81** in the necessary direction for increasing or reducing the worm **62** rotational speed.

In operation, the web **14** is fed into the web length measuring section **20** under a predetermined tension where the length passing per printing cylinder revolution is measured. If the actual measured length is above or below desired limits, engagement is made between the contact **51** and one or the other of the contacts **50**, thus creating a signal which is translated into a directional angular rotation by the reversible motor **85**. This, if greater than a predetermined minimum amount, causes a change in the position of control lever **75** which results in a variation of the worm **62** rotational input, thereby slightly altering the rotational output of the differential transmission **54** and causing a slight variation in the rotation of the feed roll couple cylinder **25**. This results in a change in web length available to the printing tower **16** per revolution of the printing cylinder **24**.

It is to be understood that although one form of this invention has been illustrated and described, it is not to be limited thereto except insofar as such limitations are included in the following claims.

I claim:

1. In combination with a rotary printing press having drive means, a web in-feeding device adapted to release with extreme precision a predetermined length of web into said press per press operation regardless of changing web demand of said press, said device comprising:

a. means forming a control couple adapted to receive the web therebetween and more therewith, a measuring member operably associated with said control couple and responsive to the web passing therethrough,

b. means forming a feed roll couple adapted to grip the web and continuously release the web for entry into said press,

c. a differential transmission including an input shaft and an output shaft and a spider assembly secured to one of said transmission shafts, rotational adjusting means in positive rotational engagement with said spider assembly for varying the rotation ratio between said transmission input and transmission output shafts,

d. a remotely operable control member comprising a variable drive having an input in positive rotational engagement with said transmission input shaft and an output in positive rotational engagement with said rotational adjusting means, said variable drive having an adjusting member adapted to vary the rotation ratio between said drive input and output, a reversible motor operably connected to said adjusting member,

e. motion transmitting means operably connected to said transmission input shaft and drive means for driving said transmission and apparatus sychronously at all speeds, motion transmitting means connecting said transmission output shaft to said feed roll couple forming means for controlling the web releasing speed thereof, and

f. means for comparing the measuring member responses and the operation of said drive means, said comparing means being operably connected to said reversible motor and selectively responsive to said responses for varying said variable drive rotation ratio.

* * * * *