Oct. 13, 1964 G. C. WRIGHT 3,152,742

COMBINED PAPER TENSION AND ALIGNMENT ADJUSTING MECHANISM FOR HIGH-SPEED PRINTERS

Filed July 5, 1962 2 Sheets-Sheet 1

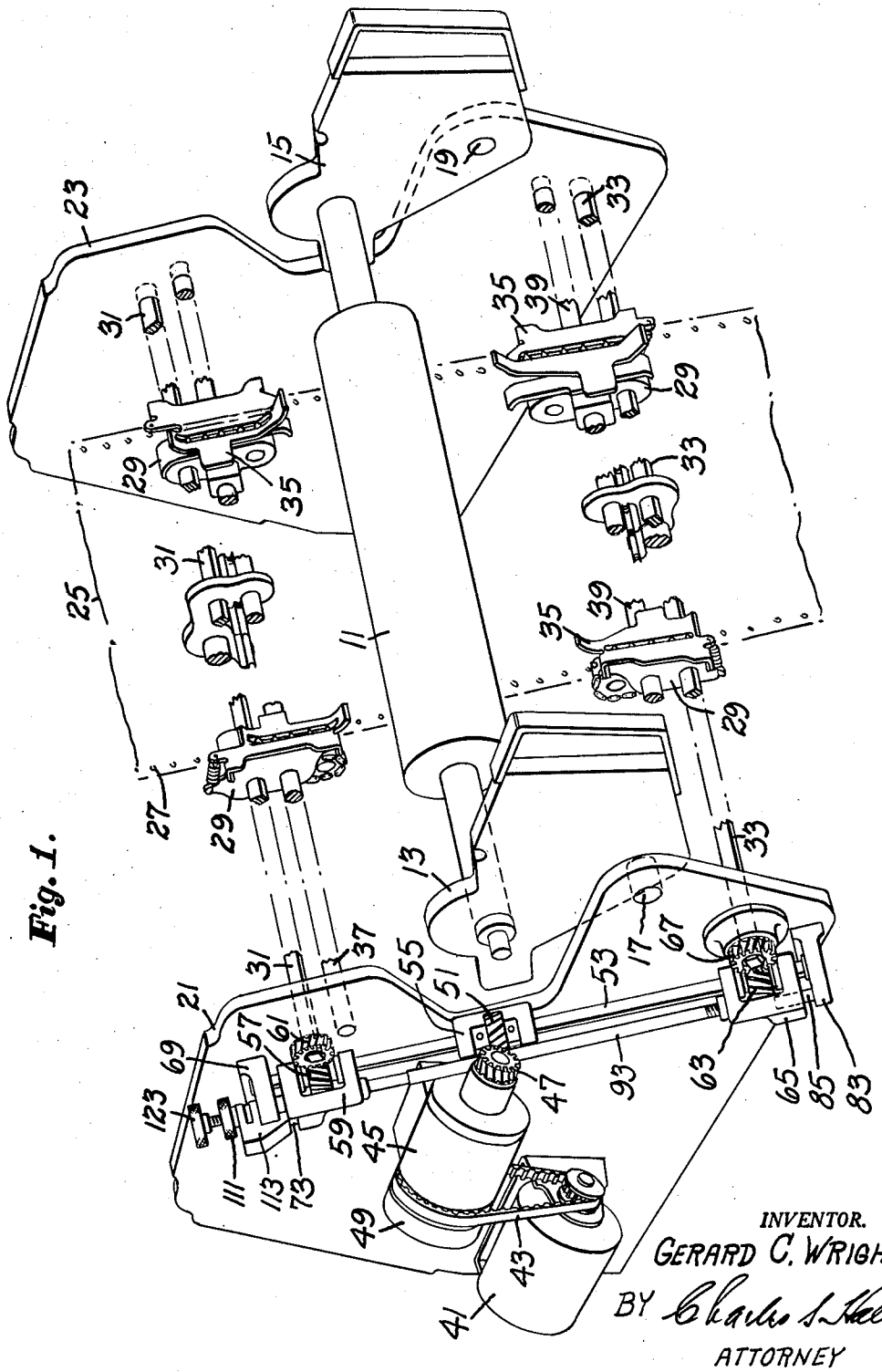


Fig. 1.

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Fig. 2.

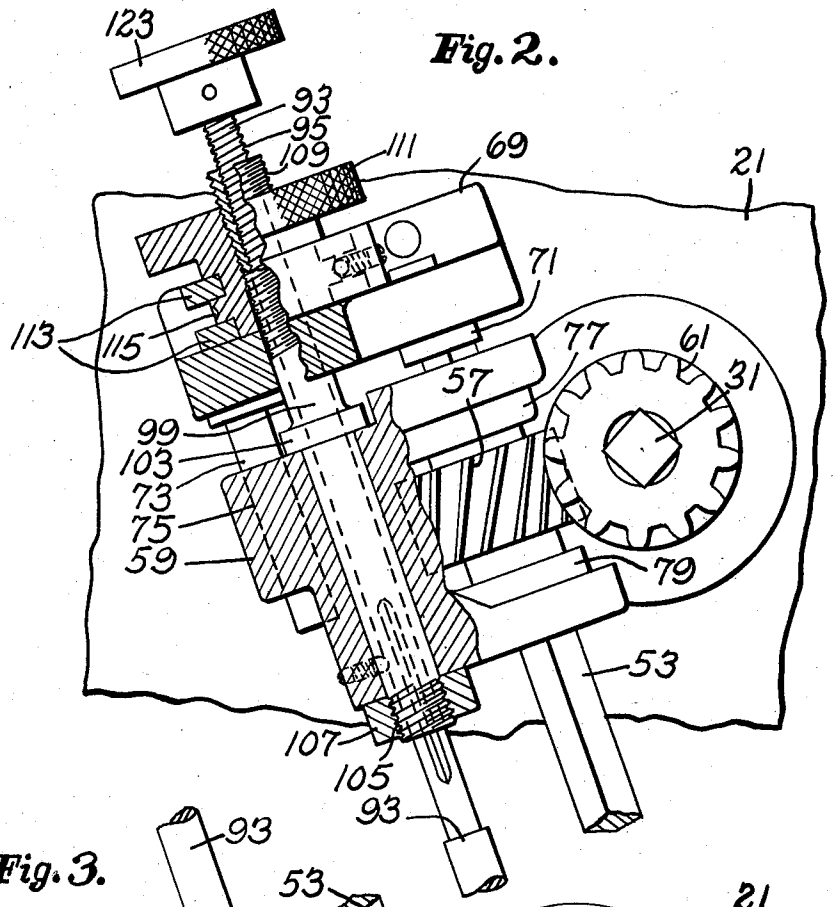
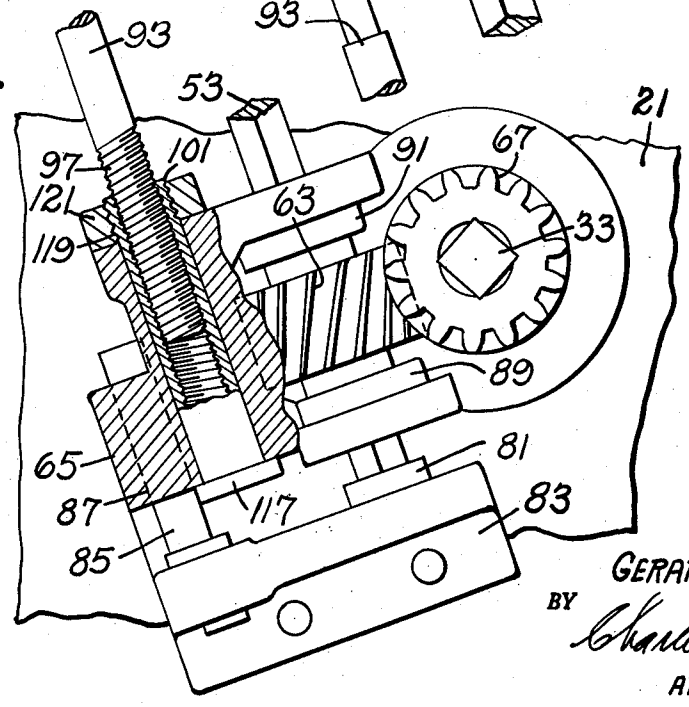


Fig. 3.



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COMBINED PAPER TENSION AND ALIGNMENT ADJUSTING MECHANISM FOR HIGH-SPEED PRINTERS

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The present invention relates to paper feeding in high-speed drum printers and particularly to combined means for varying the tension and for adjusting line-of-print of a continuous paper form or web.

Recent advances in the field of high-speed electronic data-processing machines have fostered the need for reliable output devices to record the processed intelligence information results. In particular, there has been an ever increasing demand in the art for printers to convert rapidly the electrical output signals onto a printed record.

The high-speed printers developed to date have proved extremely efficient in recording the data results as it is processed, but this in turn has placed greater demands upon the paper feeding means in keeping up with the pace set by the printer. Systems have, therefore, been fashioned to advance the paper by quickly accelerating it into successive print lines at the high speeds required and without tearing the paper. However, difficulty has been encountered with this speeded paper feeding operation in that the tension in the paper may become unsuitable or the line-of-print become displaced, resulting in an unsatisfactory quality of work or errors in registry which become cumulative unless adjustments are made by the machine operator.

It is the primary object of this invention to provide an improved means for varying the tension and for adjusting the line-of-print of the paper web form for high-speed printers.

Another object of the invention is to achieve fine adjustments in the tension and alignment of a web paper form to suit the conditions required by high-speed printers as the need arises, without disturbing the normal paper feeding operation.

A further object of the invention is to accomplish tension and print-line adjustments of a web paper form in high-speed printers through a combined unitary assembly of parts.

The present invention is incorporated into a drum printer utilizing conventional, motor driven clutch and brake mechanism and a known paper feeder, which consists of four tractor feed devices arranged in pairs, each pair being slidable upon a square drive shaft and a supporting shaft to form, respectively, an infeed and an outfeed assembly. Applicant's improvement, in accordance with the above objectives, is a combined means for imparting rotation either to both drive shafts for adjusting the line-of-print, or to only one drive shaft for varying the tension of the web paper form without disturbing the normal operation of the printer.

The novel features of the invention, both as to its organization and method of operation, together with further objects and advantages thereof, will be better understood from the following description considered in connection with accompanying drawings in which an embodiment of the invention is illustrated by way of example.

FIG. 1 is a front perspective view of a drum printer in accordance with applicant's invention.

FIG. 2 is a side view with a cut-away section of the upper outfeed portion of the combined adjusting mechanism of applicant's invention.

FIG. 3 is a side view with a cut-away section showing

the lower infeed portion of the combined adjusting mechanism of applicant's invention.

As shown in FIG. 1 the mechanism is adapted for use with a conventional drum printer having a type drum 11 which is rotatably supported by frames 13 and 15, said frames being in turn pivoted at 17 and 19 on heavy stationary frames 21 and 23. A web paper form 25, on which the printing is to be done, has perforated feed holes 27 on each margin thereof which are adaptable to four tractor feed devices 29. Each of the tractor assemblies includes a driving sprocket adapted to be rotated by means of either an upper square drive shaft 31 or a lower square drive shaft 33. The details of the sprocket devices, as well as spring-urged paper retaining covers 35, associated with each, are substantially identical to that disclosed in U.S. Patent No. 3,006,520 and therefore further description thereof is not deemed necessary. It will be seen in FIG. 1 that the sprocket feed devices 29 are adapted for sliding movement on the associated round shafts 37 and 39 which extends between the heavy frames 21 and 23. The square drive shafts 31 and 33 are supported by bearings in the left frame 21 and in the right frame 23.

The drive mechanism for the square shafts 31 and 33 includes an electric motor 41 coupled by means of a geared belt 43 with the input drive shaft of a combination clutch and brake mechanism 45, secured to the left side of frame 21. The clutch and brake mechanism 45 is of conventional design, commercially available, and is adapted to couple the drive provided by the motor 41 intermittently to an output driving gear 47. A heavy brass flywheel 49 is secured to the input shaft of the clutch and brake assembly 54 to smooth out the operation of the mechanism. Normally the brake in the assembly 45 is operative to hold the output gear 47 against rotation and the clutch is normally in a disengaged condition so that the motor 41 can be in continuous operation. When the web 25 is to be advanced, the assembly 45 is energized and de-energized very rapidly. As a result thereof, the brake is released and the clutch is engaged to cause the paper to be advanced by the required distance and then stopped. This mechanism is well known in the high-speed drum printing art and further description thereof is not deemed necessary here.

The power transfer means is provided by a gearing arrangement between the clutch and brake mechanism 45 and the two feed shafts 31 and 33. The gear 47 is shown in FIG. 1 in mesh with a helical gear 51 secured to a heavy square drive shaft 53 in a manner such that there is no relative movement between the gear 51 and the square shaft 53. The gear 51 is supported by a bearing assembly 55 on the left side of the frame 21, said bearing assembly 55 thus serving to not only support the gear 51 but also the drive shaft 53 to which the gear 51 is secured. A second helical gear 57 is carried by a movable housing 59 and is constantly in mesh with a third helical gear 61 secured to the left end of the upper feed shaft 31. In a similar manner a fourth helical gear 63 is carried by a second movable housing 65 near the lower end of the shaft 53 and is constantly in mesh with a fifth helical gear 67 secured to the left end of the lower feed shaft 33. The arrangement is such that the helical gears 57 and 63 are supported by their respective housings 59 and 65 for sliding movement on the shaft 53. Thus it will be seen that rotation of the driving gear 47 will cause a simultaneous rotation of the two feed shafts 31 and 33 through the transfer gearing arrangement associated therewith.

Referring now to FIGS. 2 and 3, the details of the construction of the support for the helical gears 57 and 63 will be described. In FIG. 2 a stationary bracket 69 is secured to the upper portion of frame 21 and is provided with a guide bearing 71 for the upper end of the

heavy drive shaft 53. Bracket 69 also has a downwardly extending stud 73 which passes through an associated opening 75 in the housing 59 which carries the upper helical gear 57 supported therein for rotation by means of bearing assemblies 77 and 79. Referring particularly to FIG. 3 it will be seen that the lower end of the heavy drive shaft 53 is similarly disposed within a second guide bearing 81 carried by a second stationary bracket 83 secured to the lower portion of frame 21. The bracket 83 has an upwardly extending stud 85 which passes through an opening 87 provided in the lower gear housing assembly 65. The lower gear 63 is likewise supported for rotation within housing 65 by means of bearings 89 and 91.

A small shaft 93, FIGS. 2 and 3, is threaded at its upper and lower ends 95 and 97 and passes through a cylindrical sleeve 99 which is carried by the upper housing 59 and also extends into a cylindrical sleeve 101 carried by the lower housing 65. The sleeves 99 and 101 have internal threads which are adapted to receive, respectively, the threaded portions 95 and 97 of the shaft 93. The pitch of the upper set of threads 95 is less than the pitch of the lower set of threads 97, thus forming a different screw, the purpose of which is hereinafter set forth. In FIG. 2 the cylindrical sleeve 99 in the upper housing has an intermediate flange 103 bearing upon the upper edge of the housing 59 and has external threads 105 at its lower end which receive a lock nut 107. Accordingly the sleeve 99 is held rigid within the upper housing 59. A portion of the sleeve 99 extends from flange 103 upwardly through the stationary bracket 69 and is provided with external threads 109 mated with internal threads of an adjustment collar 111. The upper stationary bracket 69 is provided with a retaining frame 113 which encompasses a flange 115 on the collar 111, the arrangement being such that the collar 111 is free to rotate in the bracket 69 but is held against translation. In FIG. 3 the cylindrical sleeve 101 which is threaded to receive the lower end of shaft 93 has a flange 117 at its lower end and is provided with external threads 119 at its upper end which receive a second lock nut 121. Thus it will be seen that the sleeve 101 is held rigidly within the lower housing 65.

The arrangement shown by FIGS. 2 and 3 is such that when the collar 111 is rotated, the sleeve 99 fixed to the upper housing 59 will be moved upwardly or downwardly depending upon the direction of rotation of the collar, i.e., will translate longitudinally with respect to the stationary bracket 69. Since the shaft 93 is threaded into the upper sleeve 99 and into the lower sleeve 101, longitudinal translation of the sleeve 99 caused by rotation of the collar 111 will impart a simultaneous and equal translation to the upper and lower gear housings 59 and 65. Further, because the gears 57 and 63 are constantly in mesh with the gears 61 and 67, respectively, such simultaneous translation of the gear housings and their gears 57 and 63 will cause a rotation of the associated square paper feed shafts 15 and 16 through gears 61 and 67, respectively. Thus it is apparent that a small rotation of the collar 111 can be used to make a fine adjustment of the line-of-print on the web paper form 25.

An adjustment knob 123 is affixed to the upper end of shaft 93, as shown in FIG. 2. When the shaft 93 is rotated by the turning of knob 123, there will be no effect on the location of the upper housing 59 since it is held fixed with respect to the stationary bracket 69 by means of the external threads 109 on the sleeve 99 which are threaded into the collar 111. The lower housing 65, however, is free to undergo translation when the shaft 93 is rotated and, accordingly, it is apparent that when the shaft 93 is turned either clockwise or counterclockwise the lower housing 65 and the associated gear 63, carried thereby, will be translated. The pitch of the upper threads 95 on the shaft 93 is less than the pitch of the threads 97 and, therefore, if the knob 123 is rotated in a clockwise direction one revolution, the shaft 93 will move downwardly by an amount equal to the distance between two of the fine threads 95 while the lower housing 65 will move upwardly on the shaft 93 by an amount equal to the distance between two of the coarse threads 97. The net upward movement of the housing 65 with respect to the stationary bracket 83 will thus be equal to the difference between the distances separating adjacent threads on the coarse threads 97 and the fine threads 95. Since the upper helical gear 57 does not undergo translation in response to rotation of the shaft 93, only the lower drive shaft 33 will be rotated in one direction or the other with respect to the upper shaft 31 when shaft 93 is rotated and the tension of the web is thereby varied to suited requirements.

It will be noted that this tension variation, as well as the line-of-print adjustment, can be made with the heavy drive shaft 53 in operation feeding the web form 25.

It should be further noted that the respective positions of the fine and coarse threads above referred to could be reversed. This would simply have the effect of reversing the movement of the housing 65 for a given rotation of the knob 123.

If a less fine adjustment of the feed shaft 33 is satisfactory, a modification of applicant's invention would replace the threads 95 and the internal threads on the sleeve 99 with a flange on the shaft 93 cooperating with a collar on the end of the sleeve 99. Rotation of the knob 123 would then raise or lower the housing 65 by the interaction of the threads 97 with the internal threads on the sleeve 101, the shaft 93 being rotatably secured in the sleeve 99. It is apparent also that, if a less fine adjustment of the feed shaft 33 is satisfactory, threads of like pitch on the shaft 93 at the points designated 95 and 97 could be employed.

Applicant's invention has been embodied, for purposes of illustration, in a device for varying the tension and for adjusting line-of-print of a paper web. It is obvious, however, that the invention can be used for adjustably rotating any two parallel shafts under a common drive either together or to rotate the shafts relatively one with the other. Thus the subject invention may be employed for adjustably positioning, either together or with respect to each other, a plurality of power-transferring gears or pulleys and associated shafts driven thereby which operate from a common drive shaft in a power-transfer or drive mechanism of the type described herein.

I claim:

1. In a power driven device employing a pair of parallel shafts driven from a common power shaft for positively advancing a web, a mechanism for adjustably rotating said shafts during operation comprising

first and second gear assemblies translatable along said power shaft, each having a gear for respectively rotating one of said shafts by the rotation or translation of said gear and each of said assemblies including a housing,

a rod freely rotatable in said gear assembly housing and threadably coacting with said second gear assembly housing,

a sleeve fixed to said first gear assembly housing and encompassing a portion of said rod outwardly from said second gear assembly,

means controlling the relative longitudinal position of said rod and said sleeve for adjusting the tension of said web, and

adjusting means having only one degree of movement threadably coacting with said sleeve for adjustably positioning said web.

2. In a device for advancing a web past an operating position by positive advancing means before and after the operating position, said advancing means each having a drive shaft, mechanism for rotatably adjusting the drive shafts comprising

a power shaft common to said drive shafts, first and second housed gear assemblies translatable upon said power shaft and each in continuous driving relationship respectively with one of said drive shafts, each of said drive shafts being rotatable by the translation of its gear assembly or the rotation of said power shaft,

a threaded receptacle fixed in said second housing,

a sleeve fixed in said first housing and having a portion extending outwardly from said second housing and bearing internal and external threads,

an adjusting rod parallel to said power shaft, extending through said sleeve and into said receptacle, and bearing threads coacting with said internal threads and said threaded receptacle, and

an adjusting collar, having only rotative movement, coacting with said external threads of said sleeve, whereby rotative adjustment of said rod changes the relative position of said assemblies, and

rotative adjustment of said collar translates said assemblies in parallel, with resultant adjustive rotation of the respective drive shafts.

3. In a device having parallel drive shafts for positively advancing a paper web across a printing position lying between the shafts, a combined mechanism for adjusting the tension of the web and the line-of-print, while the web is stationary or advancing, comprising

a power shaft having first and second gear assemblies independently translatable thereon and each in continuous driving relationship with a respective one of said drive shafts, each of said drive shafts being rotatable by the translation of its gear assembly or the rotation of said power shaft,

sleeve means fixed to said first gear assembly and having an internally and externally threaded portion,

receptacle means attached to said second gear assembly and having internal threads,

first adjusting means extending through said sleeve means and into said receptacle means and threadably coacting with said internal threads in said sleeve and receptacle means with both longitudinal and rotative movement, and

second adjusting means coacting with said external threads on said sleeve and having only rotative movement, whereby rotation of said first adjusting means translates said second assembly with respect to said first assembly, relatively rotating said drive shaft associated with said second assembly and thus adjusting the tension of said web, and rotation of said second adjusting means translates said assemblies together, rotating said drive shafts in the same direction and in the same degree and thus adjusting the line-of-print.

4. In an intermittently operable web advancing apparatus a device for adjustably tensioning and positioning the web comprising in combination

first and second driven shafts for positively advancing said web,

first and second gears respectively secured to said shafts,

third and fourth gears respectively and continuously engaged with said first and second gears for rotating said first and second gears by the rotation or translation of said third and fourth gears,

power means engaged with said third and fourth gears,

first and second gear housings translatable along said power means and having a spaced relationship with each other and respectively supporting said third and fourth gears for movement with respect to said power means,

a stationary support having a spaced relationship with said gear housings,

means for adjusting the spaced relationship between said housings and thereby rotating one of said shafts with respect to the other for adjusting the tension of said web, and

means for adjusting the spaced relationship between said stationary support and said housings while maintaining said spaced relationship between said housings, thereby rotating both of said shafts in the same degree and adjusting the position of said web.

5. In a power driven device employing a pair of parallel shafts driven from a common power shaft, a mechanism for adjustably rotating said shafts during operation comprising

first and second gear assemblies translatable along said power shaft and each having a housing and a drive gear, each drive gear being respectively in continuous power-applying relationship with one of said shafts for rotating said shaft by rotation or translation of said drive gear,

adjusting means having a first element secured to one of said housings and a second element capable of only rotative movement threadably coacting with said first element, and

adjustable spacing means having first and second threaded sections threaded into said first element and the other of said housings respectively,

whereby rotation of said second element of said adjusting means simultaneously translates both of said assemblies along said power shaft and rotation of said adjustable spacing means translates said other housing relative to said one housing.

6. The device of claim 5 wherein said driven shafts have mounted thereon means for positively driving a web across an operating position between said driven shafts, rotation of said second element adjusts the position of said web with respect to said operating position by rotating both of said driven shafts simultaneously, and rotation of said adjustable spacing means adjusts the tension of said web by rotating only the driven shaft associated with said other housing.

7. In a power driven device employing a pair of shafts driven from a common power shaft, a mechanism for adjustably rotating said shafts comprising

first and second gear assemblies respectively mounted in first and second housings translatably mounted on said power shaft, each gear assembly including a driving gear in continuous driving relationship with a driven gear for rotation of said driven gear by rotation or translation of said driving gear, each of said driven gears being respectively secured to one of said shafts,

a sleeve fixed to said first housing,

a rod rotatably secured in said sleeve and threadably coactive with said second housing,

adjusting means having only rotative movement for translating said sleeve and said housings attached thereto including said first and second gear assemblies, and

means for rotating said rod and thereby translating said second gear assembly with respect to said first gear assembly,

whereby translation of said first and second gear assemblies translates both said driving gears and thereby adjustably rotates said shafts in the same direction and to the same degree, and translation of said second gear assembly and its driving gear with respect to said first gear assembly and its driving gear adjustably rotates the shaft associated with said second gear assembly with respect to the other of the pair of shafts.

8. A web positioning and tensioning apparatus for use with first and second drivable shafts respectively above and below a printing position, each of said shafts having web gripping means for advancing a web upon the rotation of said shafts, wherein a similar rotation of said shafts adjusts the position of said web with reference to said printing position, and a rotation of one of said

shafts in relation to the other adjusts the tension of said web between said shafts, comprising

a driven gear fixed to each of said shafts,

driving means including a drive shaft and first and second housed gear assemblies translatable thereon, each of said assemblies having a driving gear in continuous mesh with a respective one of said driven gears for rotation of said driven gear by rotation of said drive shaft or translation of said gear assemblies thereon,

first and second stationary brackets for respectively guiding said translatable housings,

a first sleeve having internal and external threads fixed to said first housing,

a second sleeve fixed to said housing of said second gear assembly and having internal threads of a greater pitch than the internal threads of said first sleeve,

a differential screw passing through said first sleeve into said second sleeve and coacting with said

threads of said first and second sleeves for imparting a longitudinal translation of said housing of said second gear assembly and rotation of the shaft associated therewith upon rotation of said screw, and

an internally threaded collar mounted to said first stationary bracket for rotative coaction with said external threads of said first sleeve for longitudinal translation of said first sleeve and thereby said first and second gear assemblies with rotation of both of said shafts.

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