United States Patent

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[54] **ANGULAR ADJUSTMENT DEVICE FOR CYLINDER REGISTERING**
2 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **101/181,** 101/248
[51] **Int. Cl.** **B41f 13/14**
[50] **Field of Search** 101/248, 180, 181, 183; 74/395, 396

[56] **References Cited**

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ABSTRACT: A device for adjusting the instantaneous relative angular positions of two or more rotating shafts of a printing press powered by a common drive means while maintaining the shafts at a constant speed. A first and second bevel gear of the same diameter are fixed to a drive and output shaft respectively, both shafts having coincident axes of rotation. These bevel gears are in mesh with a third bevel gear, having an axis of rotation orthogonal to and pivotable around the axis of the shafts. Pivoting the axis of the third bevel gear displaces the first and second bevel gears relative to one another whereby the angular positions of the input and output shafts are adjusted without changing the speed of either shaft.

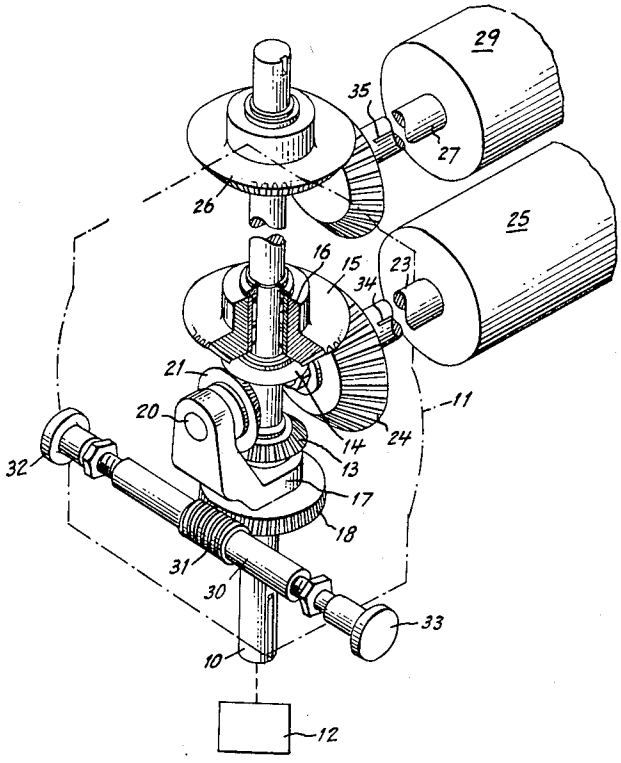


FIG. 1.

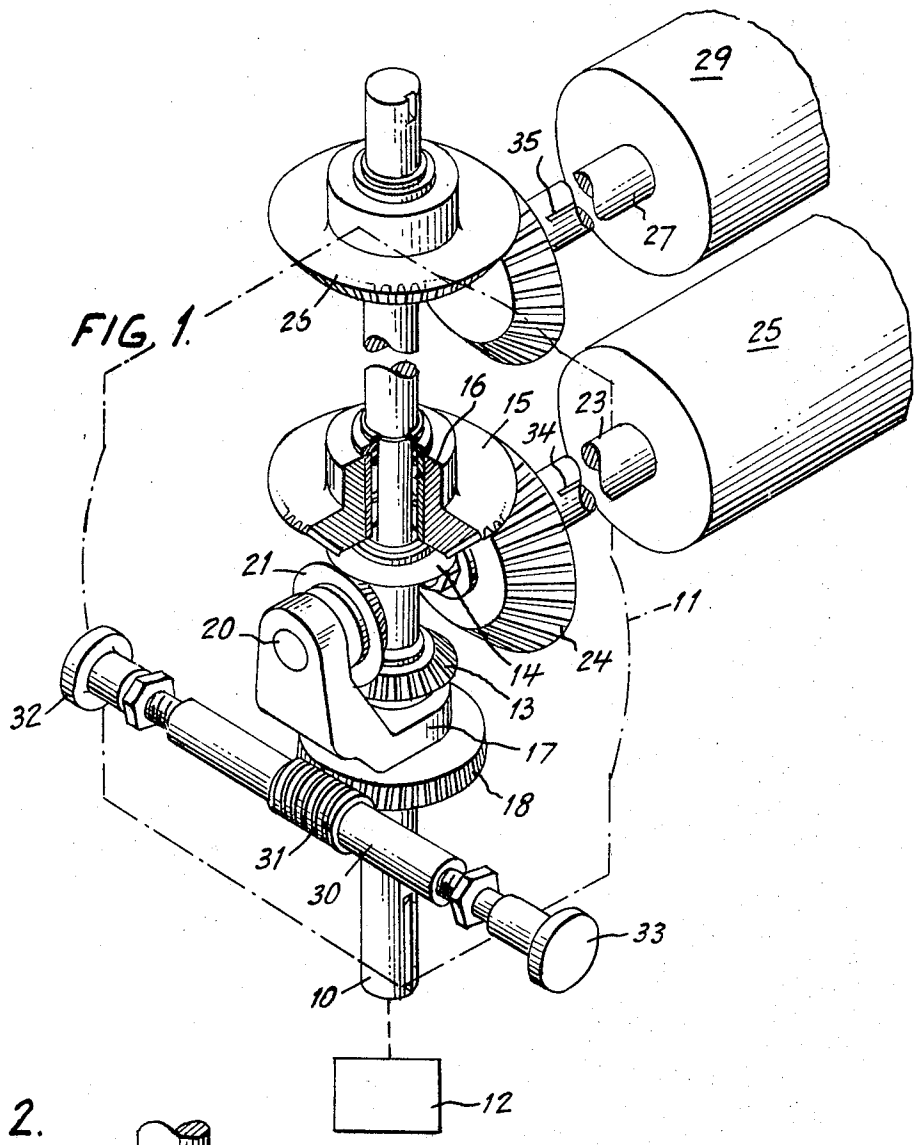


FIG. 2.

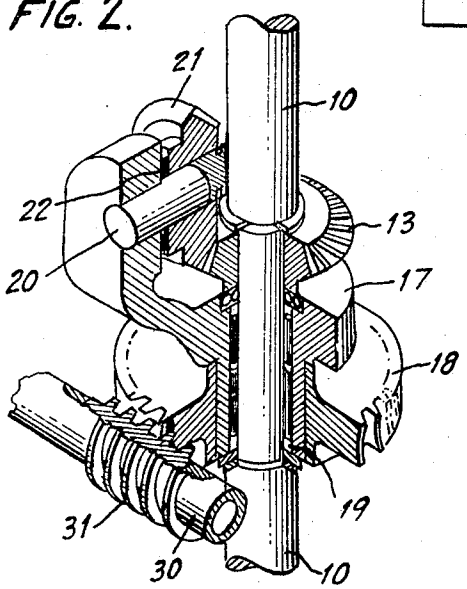
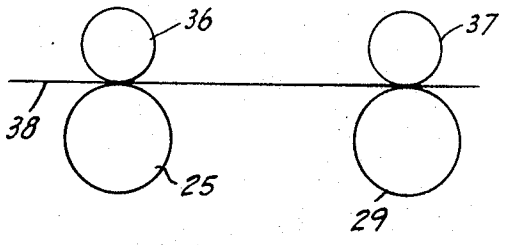


FIG. 3.



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ANGULAR ADJUSTMENT DEVICE FOR CYLINDER REGISTERING

BACKGROUND OF THE INVENTION

The present invention relates to means for synchronizing the angular positions of two or more rotating shafts of a printing press upon which cylinders are mounted. All the shafts are powered by common drive means and each cylinder may be utilized to print a portion of a desired image on a continuous printing support web stretched between the cylinders, while maintaining all cylinders at a constant speed.

In the prior art, adjustment of the registration of images transferred to the printing web by a succession of cylinders has been accomplished by the introduction of a compensator between the cylinders. The compensator was comprised of rollers which could be positioned in various ways to selectively increase or decrease the length of the printing web suspended between cylinders thereby shifting the point at which an image is transferred to a printing web by one cylinder relative to the image transferred by a prior cylinder. Such compensators not only increase the probability of smearing the image transferred to the printing support web but also have a very limited range of adjustment and require a larger press to accommodate the additional adjustment rollers.

SUMMARY OF THE INVENTION

The apparatus of this invention permits a portion of an image transferred by one cylinder of a printing press to be synchronized with another portion of an image transferred by another cylinder of the printing press, while both cylinders are being driven by a common drive means. This adjustment can be made while the cylinders are rotating and without changing the speed of either cylinder and without the use of a compensator.

Accordingly it is an object of the present invention to provide means for adjusting the relative angular positions of image bearing cylinders in a printing press, all cylinders being driven from a common drive while such cylinders are at rest or in motion, without changing the relative speed ratios of the cylinders.

Another object of the present invention is to provide means for adjusting the registration of images transferred to a printing support web by a succession of image bearing cylinders without varying the length of the printing web stretched between successive cylinders.

Another object of the present invention is to provide means for adjusting the registration of images transferred to a printing support web by a succession of image bearing cylinders without contacting the printing support web in any manner which could cause smearing of the image.

These and further objects and features of the present invention will appear from a reading of the following detailed description of one embodiment of the invention to be read in conjunction with the accompanying drawings wherein like components in the several views are identified by the same reference numeral.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric representation partially in section, of one embodiment of the present invention wherein each output shaft drives a cylinder.

FIG. 2 is a cross sectional isometric representation of one portion of the device shown in FIG. 1.

FIG. 3 is a schematic representation of two printing cylinders with a paper web stretched therebetween.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Briefly stated the above objects of the present invention are achieved in a mechanism which comprises at least one input and one output shaft rotatably mounted on a support. A first and a second bevel gear are fixed to the input and output shafts respectively. A third bevel gear having the same diameter as the first bevel gear is rotatably mounted on the same axis of rotation as the first bevel gear and is in mesh with the second bevel gear. A fourth bevel gear is in mesh with the first and third bevel gears thereby has its axis of rotation substantially orthogonal to the axis of rotation of the first and third bevel gears. Means is provided for pivoting the axis of rotation of the fourth bevel gear around the axis of rotation of the first and third bevel gears. Pivoting the fourth bevel gear displaces the first and third bevel gears relative to one another and causes the output shaft to be angularly displaced relative to the input shaft. This pivoting adjustment may be accomplished while the input and output shafts are at rest or in motion and does not affect the rotational speed of either shaft.

Referring now to FIGS. 1 and 2, the mechanism support is designated in general by the reference numeral **11**. Input shaft **10** is rotatably mounted on support **11** and can be driven in either direction by any suitable drive means **12**. Bevel gear **13** is mounted on and fixed to input shaft **10** so that it rotates with shaft **10**. Bevel gears **14** and **15** are fixed to each other with their rotational axes coincident. The assembly of bevel gears **14** and **15** is rotatably mounted on shaft **10** by means of bearing **16**. Yoke carrier **17** is mounted on and fixed to worm gear **18**. The assembly of yoke carrier **17** and worm gear **18** is rotatably mounted on shaft **10** by means of bearing **19** (see FIG. **2**), so that the axes of worm gear **18** and shaft **10** are coincident. Shaft **20** is mounted on yoke carrier **17** with its longitudinal axis substantially orthogonal to the axis of rotation of shaft **10**. Bevel gear **21** is rotatably mounted on shaft **20** by means of bearing **22** and is in mesh with bevel gears **13** and **14**. Bevel gear **21** acts as an idler gear which transmits the rotation of input shaft **10** from bevel gear **13** to bevel gear **14**. Output shaft **23** is rotatably mounted on support **11**. Bevel gear **24** is fixed to one end of output shaft **23** and in mesh with bevel gear **15**. A cylinder **25** may be fixed to the output end of shaft **23**. It can be readily seen that any rotation of shaft **10** is transmitted to cylinder **25** by means of bevel gears **13**, **21**, **14**, **15** and **24** and output shaft **23**.

Bevel gear **26** is mounted on and fixed to shaft **10** so that it rotates with shaft **10**. Shaft **27** is rotatably mounted on support **11**. Bevel gear **28** is fixed to one end of output shaft **27** and in mesh with bevel gear **26**. A second cylinder **29** may be fixed to the output end of shaft **27**. This mechanism provides a non-adjustable drive between input shaft **10** and cylinder **29** by means of bevel gears **26** and **28** and shaft **27**.

Worm shaft **30** is rotatably mounted on support **11**. Worm **31** which is fixed to or an integral part of worm shaft **30**, is in mesh with worm gear **18**. Both ends of worm shaft **30** may be equipped with hand wheels **32** and **33** which can be used to manually rotate worm shaft **30**. If desired worm shaft **30** could be driven by a drive means which may be servo controlled. Rotation of worm shaft **30** causes worm **31** and worm gear **18** in mesh therewith to rotate about their respective axes. This rotation causes yoke carrier **17**, fixed to worm gear **18** and upon which bevel gear **21** is mounted, to be pivoted. The pivoting of the axis of rotation of bevel gear **21** around the axis of rotation of shaft **10** results in a relative displacement between bevel gears **13** and **14** which in turn results in a change in the relative angular positions of shafts **23** and **27** and of cylinders **25** and **29**.

Thus it is seen that the above described mechanism not only provides means for adjusting the relative angular positions of cylinders **25** and **29** while they are in motion, without changing the speed of either cylinder, but also can be used to synchronize the angular positions of a succession of cylinders in a printing press.

To further explain the present invention, if a stroboscope was set to flash at the speed of rotation of cylinders **25** and **29** and directed at timing marks **34** and **35** on shafts **23** and **27** respectively, it would seem to the viewer that both marks had stopped rotating. In the present invention a method of moving timing mark **34** in either direction with respect to timing mark **35**, without changing the rotational speed of either shaft is disclosed.

Referring now to FIG. 3, cylinders 25 and 29 are schematically shown disposed in a line. Pinch rollers 36 and 37 urge printing support web 38 against cylinders 25 and 29 respectively. In order to further explain the utility of the present invention, assume that cylinders 25 and 29 each apply to printing support web 38 a portion of a particular design which requires registration between cylinders 25 and 29. It is quite clear that the speed of only one cylinder, 25 or 29, cannot be changed as that would cause paper support web 38 between cylinders 25 and 29 to either bunch up or to be stretched and torn. The present invention permits the angular position of cylinder 25 to be adjusted relative to the angular position of cylinder 29 without changing the speed of either cylinder while both cylinders are rotating.

The embodiment of this invention described above utilizes a single adjustable output shaft. This specification is not intended to limit the present invention in this respect. More than one output shaft may be driven by the same input shaft but each shaft would require the mechanism shown in FIG. 1. It is also possible, in a particular application, to utilize the mechanism of this invention to drive each output shaft at a different speed. The speed of each output shaft is dependent solely upon the gear ratio connecting it with the input shaft. It would also be possible to eliminate bevel gear 15 and drive bevel gear 24 directly from bevel gear 14 without departing from the spirit of the present invention. The problems inherent in this type of a modification are: the gear ratios that may be employed are limited because bevel gear 24 would have to be smaller than bevel gear 21; and the adjustment range is limited to less than 360° because bevel gear 21 could not be pivoted past bevel gear 24.

I claim:

1. In combination with a printing press wherein a succession of cylinders driven by a single drive means are provided the improvement which comprises:

a. an input shaft rotatably mounted on the printing press;

b. a first bevel gear fixed to said input shaft;

c. an output shaft rotatably mounted on the printing press;

d. means for coupling one end of said output shaft to a cylinder;

e. a second bevel gear fixed to the other end of said output shaft;

f. a third bevel gear of the same diameter as said first bevel gear rotatably mounted on the printing press on the same axis of rotation as said first bevel gear and in mesh with said second bevel gear;

g. a fourth bevel gear in mesh with said first and third bevel gears, the axis of rotation of said fourth bevel gear being substantially orthogonal to the axis of rotation of said first and third bevel gears; and

h. means for mounting said fourth bevel gear so as to permit its axis of rotation to be pivoted around the axis of rotation of said first and third bevel gears, displacing said first and third bevel gears relative to one another;

whereby the cylinder attached to said output shaft has its angular position adjusted relative to the angular positions of the other cylinders while the cylinders are in motion without changing the speed of any cylinder.

2. The mechanism recited in claim 1 wherein said mounting means for said fourth bevel gear comprises:

a. a worm shaft rotatably mounted on the printing press;

b. a worm fixed to said worm shaft;

c. a worm gear rotatably mounted on the same axis of rotation as said first bevel gear and in mesh with said worm; and

d. a yoke carrier mounted on and fixed to said worm gear for rotatably mounting said fourth bevel gear;

whereby rotating said worm shaft pivots the axis of rotation of said fourth bevel gear around the axis of rotation of said first and third bevel gears.