March 27, 1962 G. O. FROSTAD 3,026,798

PRINTING APPARATUS

Filed March 15, 1960 3 Sheets-Sheet 1

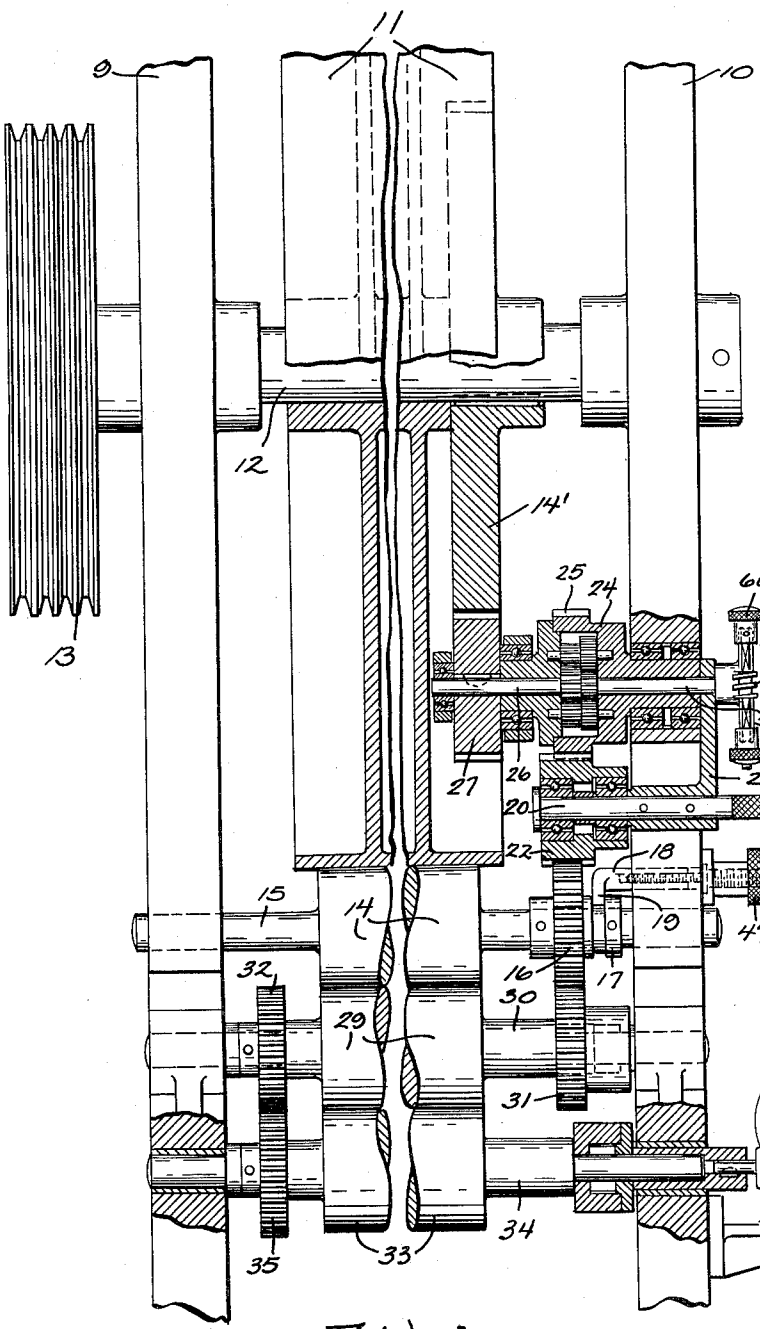


Fig. 1

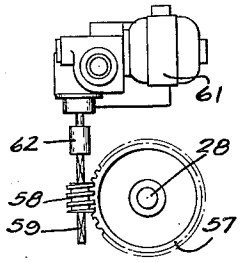


Fig. 3

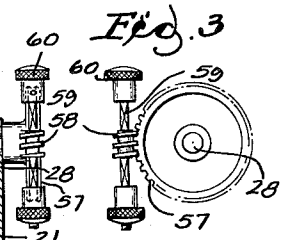


Fig. 2

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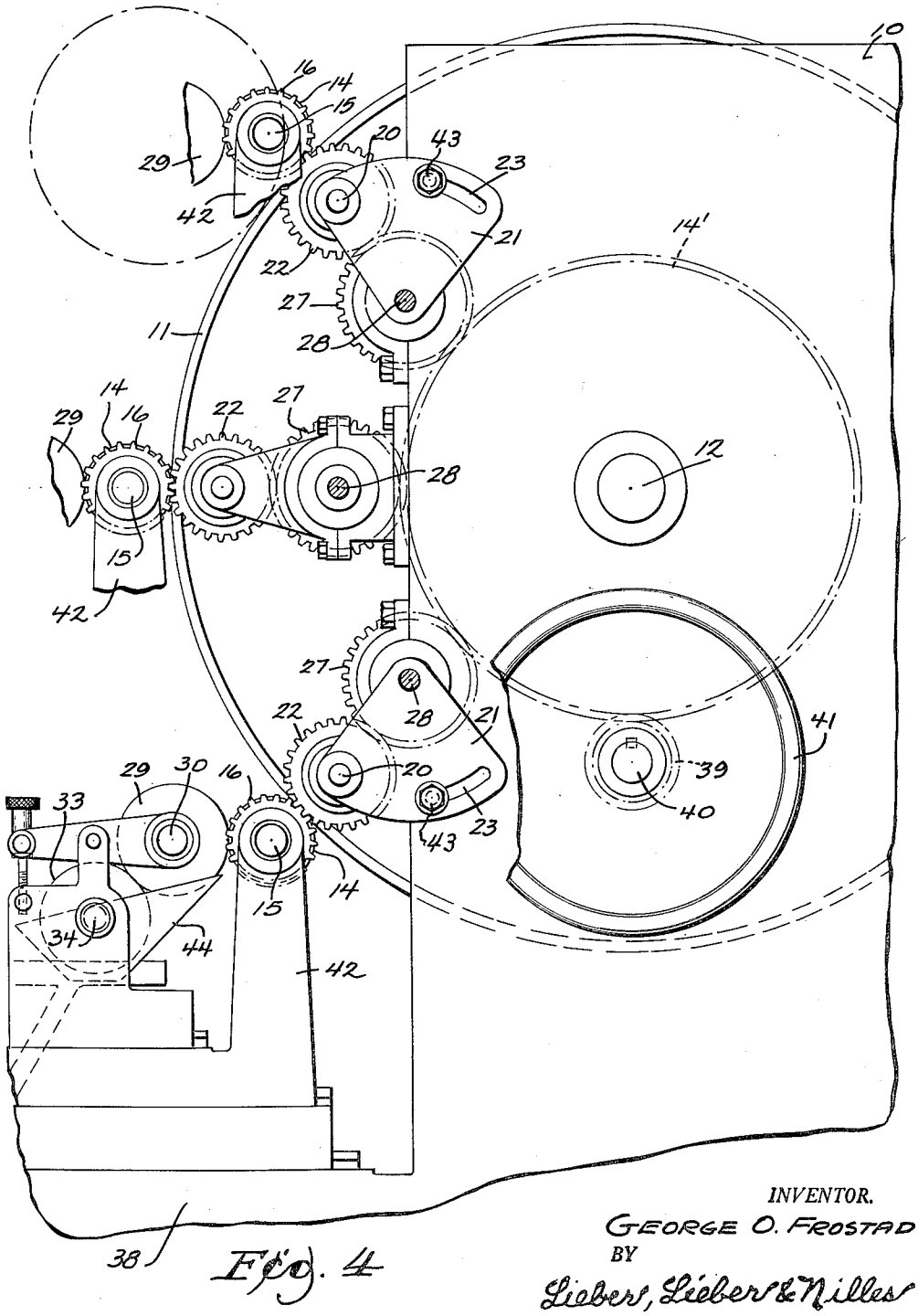


Fig. 4

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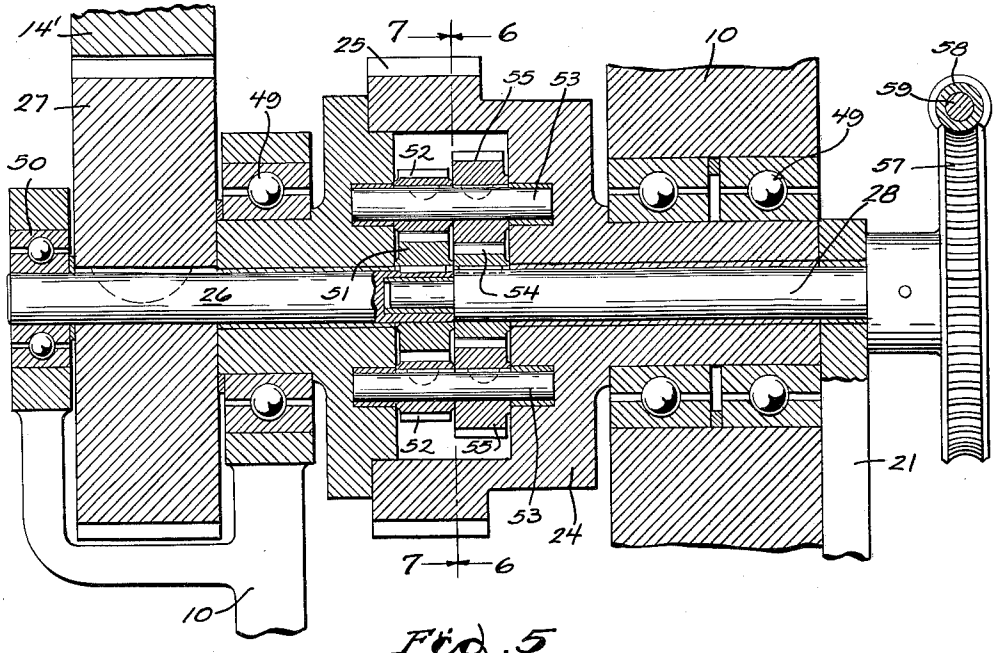


Fig. 5

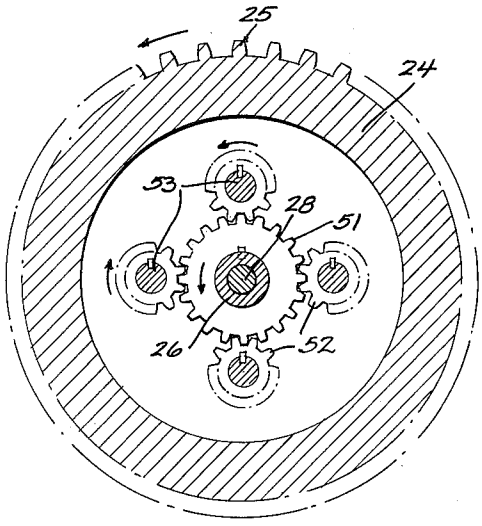


Fig. 6

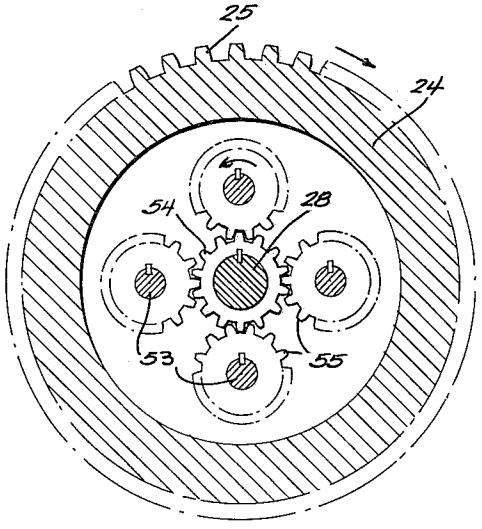


Fig. 7

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3,026,798

PRINTING APPARATUS

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3 Claims. (Cl. 101—248)

This invention relates generally to improvements in the art of printing, and it relates more specifically to improvements in the construction and operation of mechanism for effecting perfect registry of superimposed color impressions applied during multi-color printing by single impression cylinder presses.

The principal object of the present invention is to provide improved multi-color printing apparatus wherein precise registry of superimposed color impressions is obtainable in simple press assemblages.

As shown and described in Patent No. 2,283,003, granted May 12, 1942, I have heretofore proposed to obtain proper registry of superimposed impressions applied by several plate cylinders to webs coacting with a single central impression cylinder with the aid of one or more manually manipulable forks cooperating with helical gears interposed between the driving shafts of the cylinders. By manually adjusting these forks applied to the several plate cylinders it is possible to readily obtain perfect longitudinal or transverse relative adjustment and registry of the cooperating cylinders and while it is also possible to secure relative rotary or circumferential adjustment and registry the extent of the latter is limited by the helical angle of the gears connecting the cylinder driving shafts to a total of approximately one-half inch circumferentially on the advancing web. Such limited rotary adjustment is not sufficient in all cases, and it is moreover a relatively tedious job to effect even such restricted adjustment with the forks.

It is therefore a more specific object of my present invention to provide improved and more conveniently operable mechanism for effecting perfect longitudinal and rotary registry of several superimposed impressions applied to a web coacting with a single central impression cylinder by plate cylinders cooperating with the periphery of the single impression cylinder of the press.

Another specific object of this invention is to provide a device for producing precise rotary registration of the superimposed impressions applied to printed webs by a single impression cylinder press, without the aid of helical motion transmitting gears interconnecting the several cylinders.

A further important object of the invention is to provide readily adjustable means for effecting perfect relative rotary adjustment and registry of applied impressions between the impression and plate cylinders of a single impression cylinder multi-color press through a 360° angle equal to the complete circumference of each plate cylinder.

Still another important specific object of my invention is to provide a simplified adjusting assemblage for effecting proper longitudinal and rotary registry of superimposed impressions printed on single impression cylinder presses, which eliminates tedious set-up when starting the press and which is also operable by remote control during normal printing operation.

These and other more specific objects and advantages of the present invention will be apparent from the following detailed description.

A clear conception of the several features constituting the present improvement, and of the construction and functioning of a typical printing press embodying the invention, may be had by referring to the drawings accompanying and forming a part of this specification

wherein like reference characters designate the same or similar parts in the various views.

FIG. 1 is a fragmentary part sectional view taken centrally through the impression cylinder and through one of the plate cylinder adjusting mechanism of a single central impression cylinder press of the general type shown in my prior patent above referred to;

FIG. 2 is a diagrammatic showing of a manually operable device such as illustrated in FIG. 1, for effecting direct adjustment of one of the improved impression registering differential mechanisms;

FIG. 3 is a similar diagram illustrating a remote control motor driven device for effecting adjustment of one of the improved impression registering differential mechanisms;

FIG. 4 is a fragmentary side elevation of the press shown in FIG. 1, illustrating three plate cylinder assemblages cooperating with the single central impression cylinder;

FIG. 5 is an enlarged central longitudinal section through one of the rotary impression registers differentials constituting the present invention;

FIG. 6 is a transverse section through the differential mechanism of FIG. 5, taken along the line 6—6 and looking toward the left; and

FIG. 7 is a similar transverse section through the same differential mechanism, taken along the line 7—7 of FIG. 5 but looking toward the right.

While the invention has been shown and described herein as having been embodied in a rotary color registration unit embodying a two to one ratio in order to equalize the surface travel of the plate and impression cylinders, it is not necessary to utilize such ratio since others may be used to accomplish the desired results; and it is also contemplated that specific descriptive terms employed herein be given the broadest possible interpretation consistent with the actual disclosure.

With reference to the drawing, the single impression cylinder press shown, comprises in general a pair of spaced frames **9**, **10**; a relatively large diameter impression cylinder **11** mounted between the frames **9**, **10** upon a shaft **12** journalled in these frames, the shaft **12** being provided at one end with a driving sheave **13** and near its opposite end with a main spur gear **14'**; a series of three plate cylinders **14** of smaller diameter also mounted between the frames **9**, **10** upon axially shiftable shafts **15** which are bodily adjustable relative to the shaft **12**, each shaft **15** being provided near one end with a pinion **16** having a recessed collar **17** secured thereto and the plate cylinders **14** being peripherally cooperable with the periphery of the single impression cylinder **11**; a longitudinal impression registry varying member **18** adjustably coacting with the frame **10** adjacent to each plate cylinder **14** and having a fork **19** engageable with the recess of the adjacent collar **17**; a normally fixed but bodily adjustable shaft **20** mounted in a swinging bracket **21** adjacent to each member **18** and rotatably supporting a spur gear **22** adjustable about a shaft **28** and provided with an arcuate slot **23**; a rotary impression registry adjusting differential having a rotary casing **24** provided with spur gear teeth **25** meshing with the gear **22**, and also having a rotary shaft **26** provided at one end with a pinion **27** meshing with the main gear **14'** while its opposite end is alined with the normally fixed but rotatably adjustable rotary impression registry shaft **28** which provides a pivot for the adjacent bracket **21**; two sets of differential gears within the casing **24** for transmitting rotary motion at a two to one ratio between the gear **14'** and the pinions **16**; an ink transfer roll **29** coacting peripherally with each plate cylinder **14** and having a drive shaft **30** journalled in the frames **9**, **10** and provided with a pinion **31** near one end meshing with

the adjacent pinion 16 and near its opposite end with another pinion 32; and an ink feed roll 33 coacting peripherally with each transfer roll 29 and having a drive shaft 34 also journalled in the frames 9, 10 and provided near one end with a pinion 35 meshing with the adjacent pinion 32 and at its opposite end with a propelling motor 36.

The spaced side frames 9, 10 are of sturdy construction being mounted upon a common base 38, and the drive shaft 12 of the single impression cylinder 11 is fixed against axial displacement relative to the frames 9, 10 so that this cylinder cannot move axially. The main gear 14' which is secured to the impression cylinder 11 may also coact with a pinion 39 carried by a shaft 40 journalled in the frame 10, and having thereon a hand wheel 41 for manually actuating the press when changing setups, as shown in FIG. 4. Each of the plate cylinder and inking assemblages is mounted upon an auxiliary frame 42, and these frames are adjustable relative to the impression cylinder 11 so as to insure proper cooperation of the plate cylinders 14 therewith. The brackets 21 which are swingably adjustable about the pivot shaft 28 to vary the positions of the gears 22 relative to the adjacent plate cylinder pinions 16 and the differential teeth 27, may be locked in adjusted position by cap screws 43 coacting with the bracket slots 23 and with the frame 10, and the ink supply pans 44 and transfer rolls 29, 33 which are adjustably mounted upon the auxiliary frames 42 are of well known construction.

The adjusting members 18 associated with the several plate cylinders 14 and which function to obtain precise or perfect longitudinal or transverse registry of the impressions which are superimposed upon the web advancing around the cylinder 11, are substantially the same as those shown and described in my prior patent. Each of these members 18 is adjustable transversely of the adjacent frame 10 by means of a screw 46 which shifts the fork 19 coacting with the adjacent grooved collar 17 and thereby moves the corresponding plate cylinder 14 axially relative to the common impression cylinder periphery, and each screw 46 is adapted to be held in adjusted position by a lock nut 47, see FIG. 1. During such adjustment of the individual plate cylinders the pinions 16 are slidable along the teeth of the wider spur gear 22 which is freely rotatable about the normally fixed shaft 20 and meshes with the teeth 25 formed on the differential casing 24.

The differentials for effecting precise or perfect rotary or circumferential registry of the impressions imposed upon the web being printed, constitutes an important part of the present invention as applied to a single impression cylinder press. As shown in FIGS. 5, 6 and 7, each 360° color registry device comprises the two part casing 24 one part of which has the annular series of teeth 25 formed thereon but both parts of which are journalled for free rotation in anti-friction bearings 49 mounted in the frame 10; the shaft 26 having the pinion 27 keyed thereto and which is journalled for free rotation in another anti-friction bearing 50 also mounted in the frame 10; the shaft 26 having the pinion 51 keyed thereto and which is located within the casing 24; the normally fixed but rotatably adjustable shaft 28 also extending into the casing 24 in axial alinement with the revolving shaft 26; and the two to one ratio differential gearing confined within the casing 24. This gearing consists of the spur gear 51 keyed to the inner end of the shaft 26 and meshing with a cluster of pinions 52 also secured to the shafts 53. The gear 51 is of larger diameter than the gear 54, and the latter meshes with a similar cluster of pinions 55 which are also secured to the shafts 53, but the pinions 52 are of smaller diameter than the pinions 55. The two planetary gear sets are constructed to produce a two to one speed ratio between the gear teeth 25 and the gear 27, and these must have like pitch diameters and the same number of teeth in order to maintain this ratio.

The outer end of the normally fixed shaft 28 is provided with a worm wheel 57 which meshes with a worm 58 secured to an adjusting shaft 59 mounted in bearings secured to the adjacent frame 10. As shown in FIGS. 2 and 3, this shaft 59 of each differential may be independently rotatably adjusted either manually by means of a hand knob 60 secured to an end of the shaft as in FIG. 2, or from a remote station by means of an electric motor 61 connected to the shaft end by a coupling 62 as in FIG. 3. By rotating the shaft 59, the worm 58 will rotate the worm wheel 57 thereby revolving the differential casing 24 through the gear 54 and pinions 55 thus rotating the adjacent plate cylinder 14 through the pinions 16, 22 without rotating the impression cylinder 11. The extent of this differential rotation of each plate cylinder 14 may be carried through 360°, but will, of course, depend upon the degree of adjustment being effected through the shaft 59, and the worm 58 coacting with the worm wheel 57 will positively lock the differential casing 24 in properly adjusted position.

When the press is being set up for a particular color printing job, the single impression cylinder 11 may be rotated to advance a web about its periphery, either manually with the aid of the hand wheel 41 or by power applied to the sheave 13, and exact longitudinal or transverse registry of the superimposed printed impressions imposed by the several plate cylinders can be readily effected by merely manipulating the screws 46 to adjust each plate cylinder 14 through its adjusting member 18. Then in order to effect exact rotary or circumferential registry of the superimposed printed impressions, it is only necessary to rotate the adjusting shaft 59 of each plate cylinder until precise registry of all impressions has been effected, whereupon the press is ready for normal printing operation. A simple but highly efficient assemblage for effecting convenient and precise registry of all multi-color impressions applied to a web by a single impression cylinder press is thus provided, and the extent of relative displacement of each plate cylinder 14 relative to the single central impression cylinder 11 is not limited as in my prior patented press but may be extended through 360°. The individual registry operation applied to each plate cylinder 14 through its differential mechanism does not affect any of the other plate cylinders, and while the number of pinions in each cluster may be varied, the two to one speed ratio in order to equalize surface travel of the coacting plate and impression cylinders must be retained.

As shown in dot and dash lines at the top of FIG. 4, the diameters of the plate cylinders 14 may be varied, and while the central plate cylinder 14 will always remain on dead center relative to the plate cylinder 11, the adjustable brackets 23 may be utilized to cause the others to properly cooperate with the single impression cylinder 11. The improved registry effecting mechanism vastly reduces the time and effort required to secure precise registry of all impressions and all adjustments may be made from one side of the press while rotary or circumferential registry may also be effected from a common remote station through a reversible geared motor 61. The improved device has proven highly successful as applied to a single central impression cylinder press, and is far superior than the prior devices which are able to obtain only limited rotary registration, but the differential adjustment may also be effectively applied to stack presses.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. Printing apparatus comprising, a single impression cylinder rotatable about an axis, at least two plate cylinders coacting with the periphery of the impression cylinder and being rotatable about independent axes disposed

parallel to said impression cylinder axis, a gear rotatable with said impression cylinder, a pinion rotatable with each of said plate cylinders, and a rotary impression registry differential having a casing geared to said pinion and a rotary shaft geared to said impression cylinder gear and connected to said casing by planetary gearing, said differential being constructed to maintain a two-to-one speed ratio between said impression cylinder and all of said plate cylinders.

2. Printing apparatus comprising, a single impression cylinder rotatable about an axis, at least two plate cylinders coacting with the periphery of the impression cylinder and being rotatable about independent axes disposed parallel to said impression cylinder axis, a spur gear secured to and rotatable with said impression cylinder, a spur gear pinion rotatable with each of said plate cylinders, a rotary impression registry differential having a casing provided with peripheral teeth geared to said pinion and a rotary shaft geared to said impression cylinder gear and connected to said casing by internal planetary spur gearing, said differential being constructed to maintain a two-to-one speed ratio between said impression cylinder and all of said plate cylinders, and means for effecting 360° rotary adjustment of said differential casing.

3. Printing apparatus comprising, a single impression cylinder rotatable about an axis, at least two plate cylinders coacting with the periphery of the impression cylinder and being rotatable about independent axes disposed parallel to said impression cylinder axis, a spur gear secured to and rotatable with said impression cylinder, a spur gear pinion rotatable with each of said plate cylinders, a rotary impression registry differential having a casing provided with peripheral teeth geared to said pinion and a rotary shaft geared to said impression cylinder gear and connected to said casing by internal planetary spur gearing, said differential being constructed to maintain a two-to-one speed ratio between said single impression cylinder and all of said plate cylinders, and means for effecting rotary adjustment of said differential casing.

References Cited in the file of this patent

UNITED STATES PATENTS

748,412	Norris	Dec. 29, 1903
2,283,003	Frostad et al.	May 12, 1942
2,747,504	Fay	May 29, 1956