L. HUFFMAN.

IMPRESSION APPARATUS.

APPLICATION FILED AUG. 22, 1910. RENEWED JUNE 23, 1911.

1,018,617. Patented Feb. 27, 1912.

4 SHEETS—SHEET 1.

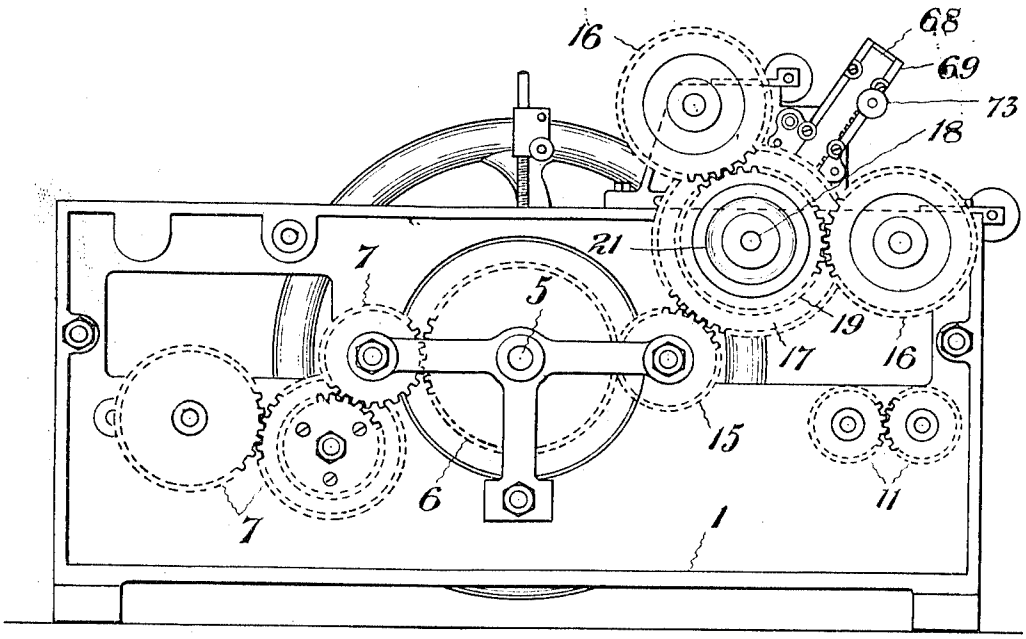

Fig. 1

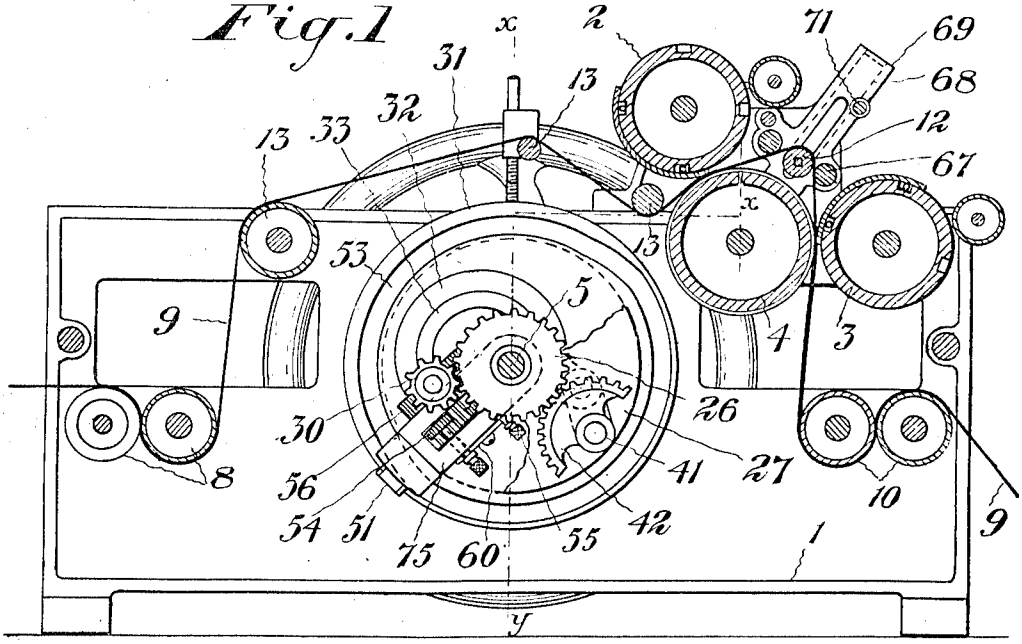

Fig. 2

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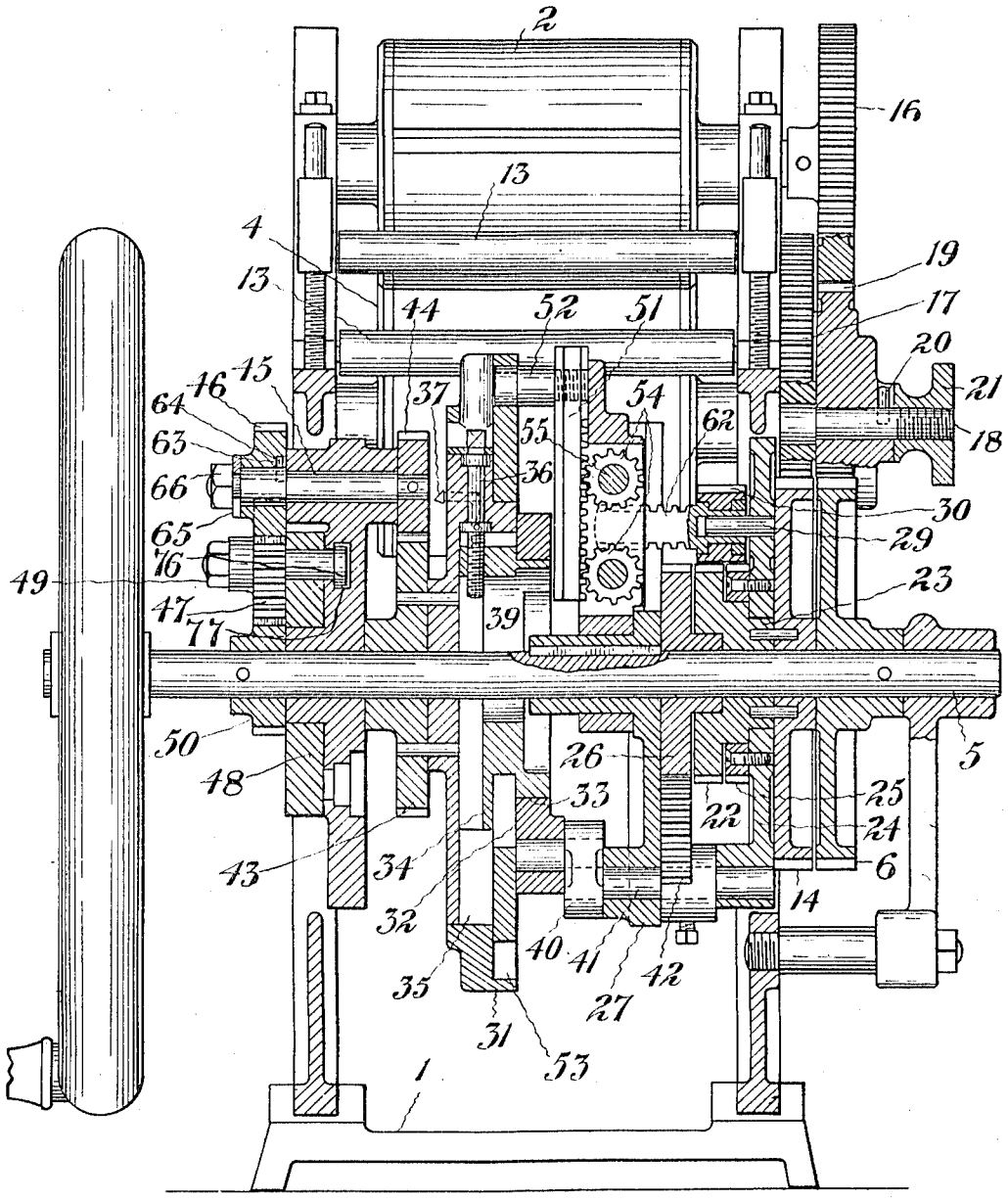

Fig. 3.

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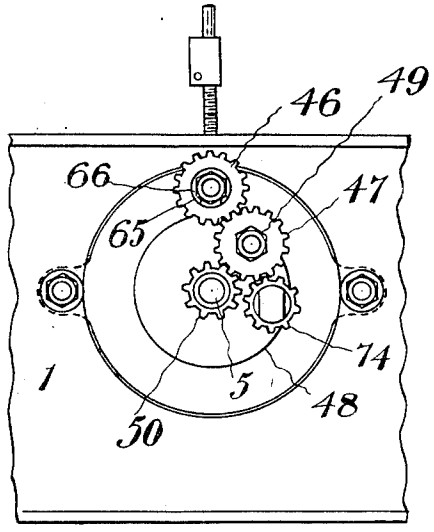

Fig. 4

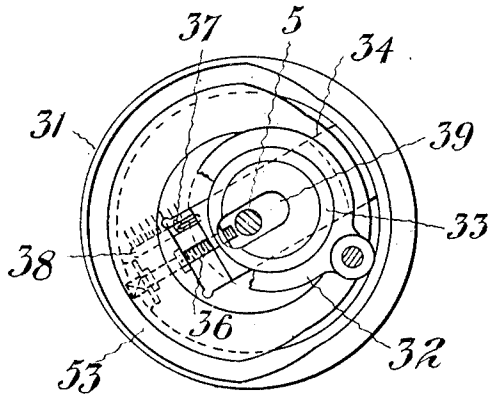

Fig. 5

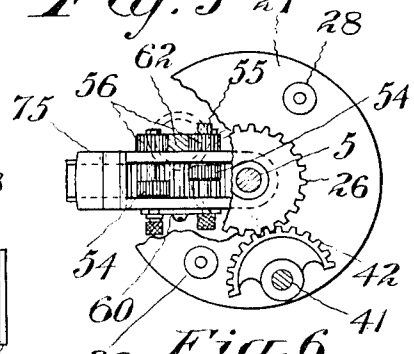

Fig. 6

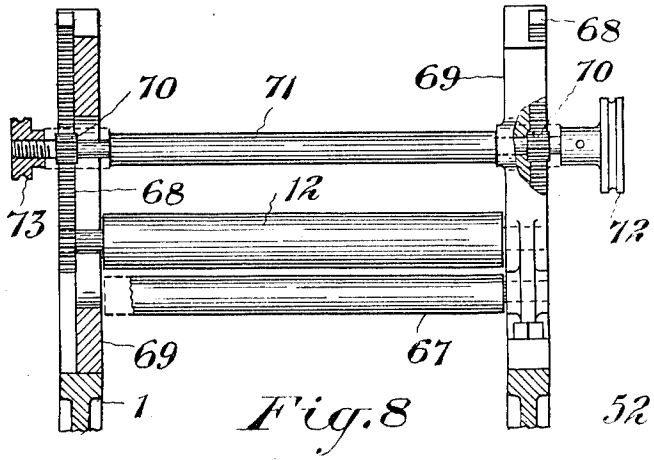

Fig. 8

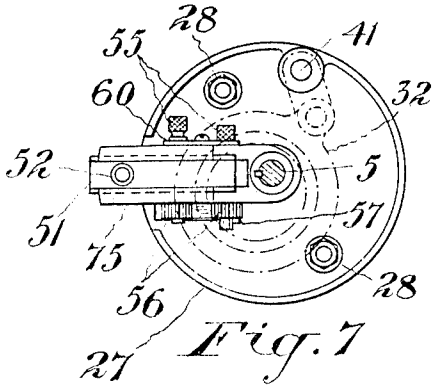

Fig. 7

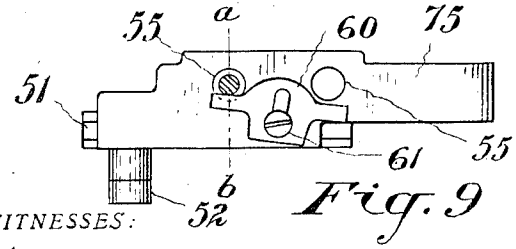

Fig. 9

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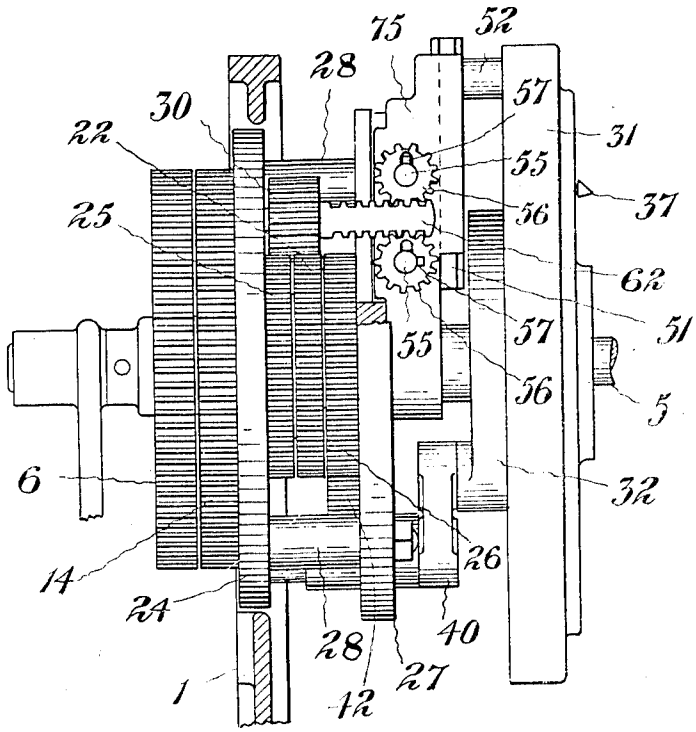

Fig. 10

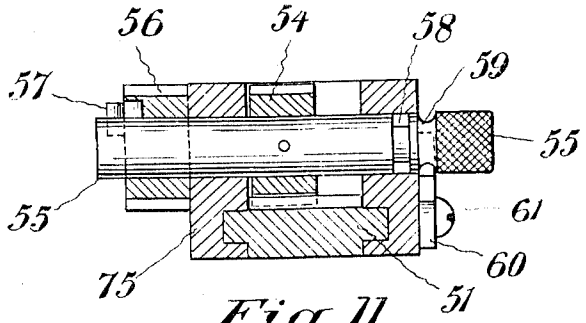

Fig. 11

WITNESSES:

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UNITED STATES PATENT OFFICE.

LOUIS HUFFMAN, OF TORONTO, ONTARIO, CANADA.

IMPRESSION APPARATUS.

1,018,617. Specification of Letters Patent. Patented Feb. 27, 1912.

Application filed August 22, 1910, Serial No. 578,387. Renewed June 23, 1911. Serial No. 635,022.

To all whom it may concern:

Be it known that I, LOUIS HUFFMAN, of the city of Toronto, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Impression Apparatus, of which the following is a specification.

This invention relates to apparatus such as disclosed in my prior United States Patents No. 938,381 of Oct. 26, 1909, and No. 946,224 of Jan. 11, 1910, in which I described apparatus which rendered it possible, taking a cylinder printing press as a concrete example, to print on a continuous web of paper impressions at intervals other than those represented by the circumference of the cylinder or cylinders, or aliquot parts thereof. This result was obtained by employing segmental printing means driven at a uniform speed during the printing part of each rotation and at a different speed during the non printing part of each rotation. As the printing and non-printing parts of each rotation took place in the same length of time, one segmental printing means left blanks on the paper which were filled in by a second segmental printing means similarly driven.

It is evident that, when a segment is not printing, its speed might be slower or faster than when it is printing and it is the object of the present invention to devise improved driving mechanism with which both a retardation and an acceleration may be obtained in one machine and the range of sizes, which may be conveniently printed, thus increased.

I attain my object by the constructions hereinafter described and illustrated in the accompanying drawings in which—

Figure 1 is a side elevation of the apparatus. Fig. 2 is a longitudinal section of the same. Fig. 3 is a cross-section of the same on the line X, Y, in Fig. 2. Fig. 4 is a side elevation of part of the machine showing part of the gearing for rotating the cam which controls the drive for the printing cylinders. Fig. 5 is a face view of the cam and the eccentric for differentiating the speed of the printing cylinders. Fig. 6 is a detail in side elevation showing particularly the differentiating gear and the shiftable mechanism which determines the actuation of the printing means at normal or differentiated speed. Fig. 7 is a detail in side elevation showing particularly the eccentric for producing differentiated speed. Fig. 8 is a front elevation partly in section, of the paper adjusting means. Fig. 9 is a plan view of part of the shifting means of the shiftable pinion of the speed changing mechanism. Fig. 10 is a front elevation of the driving mechanism. Fig. 11 is a section on the line *a b* in Fig. 9.

1 is the frame of the machine suitably shaped to support the different parts. On the frame are suitably journaled two printing cylinders 2 and 3. A single impression cylinder 4 is journaled in a suitable position to coöperate with both the printing cylinders 2 and 3.

5 is the driving shaft. This shaft is provided with a gear wheel 6 driving by means of the gear train 7 the feed rollers 8. The paper 9 passes between two suitably journaled guide rollers 10 geared together by the gearing 11, thence between the printing cylinder 3 and the impression cylinder 4, thence over a roller 12 the purpose of which will hereinafter appear, thence between the printing cylinder 2 and the impression cylinder 4, thence around the guide rollers 13 and around and between the feed rollers 8. As long, therefore, as the shaft 5 is run at constant speed the feed of the paper will be uniform.

As set out in the preamble to the specification it is my object to drive each of the printing cylinders 2 and 3 at a different speed during a portion of each rotation, which differentiated speed may be either a retardation or an acceleration of the normal speed. This means that the printing cylinders cannot be driven from gearing secured to the driving shaft 5. To secure this variable rotary motion of the printing cylinders I provide the gearing which I will now describe and which periodically accelerates or retards the speed rotation of the cylinders according to its setting.

On the driving shaft there is loosely mounted a driving gear wheel 14 driving through the medium of the gear train 15 the impression cylinder 4. The impression cylinder by means of the gear train 16 actuates the printing cylinders 2 and 3. It will be noted that the wheel 17 of the gear train 15 is loose on the spindle 18 of the impression roller and that the wheel 19 of the gear train 16 is movable longitudinally on the spindle but is held from rotating by means of the pin 20 fitting a notch in the hub of

the wheel. A nut 21 screwed on to the end of the spindles provides means whereby the wheels 17 and 19 may be clamped together to form a driving connection between them. See Figs. 1 and 3.

The construction just described provides means whereby the printing cylinders and impression roller may be thrown out of gear with the rest of the mechanism and rotarily adjusted to cause the impressions to occur in synchronism with the setting of the drive.

On the driving shaft is loosely mounted a driven gear wheel 22 connected through the medium of its hub 23 with the gear wheel 14. See Fig. 3.

Fast relative to the shaft and located between the gears 14 and 22 is a disk 24 carrying the normal-speed gear wheel 25. On the other side of the gear wheel 22 is located the differentiating gear wheel 26 loose on the shaft 5. Beside this differentiating gear wheel 26 is the disk 27 rotating with the shaft and preferably connected with the disk 24 by the stay bolts 28, thus giving the disk 24 and gear 25 their driving connection with the shaft.

The guide 29 is secured to the disk 24 and on this guide a pinion 30 is adapted to slide, its teeth being of sufficient width to engage at one time the teeth of either the driven gear 22 and the normal speed gear 25 or the teeth of the driven gear wheel 22 and the differentiating gear wheel 26. It is evident in the former case that the driven gear 22 will be rotated at the same speed as the shaft 5 and in the latter case at the same speed as the differentiating gear whatever that may be.

Before describing the means for automatically moving the pinion 30 it will be necessary to describe the means for actuating the differentiating gear wheel 26.

On the shaft there is loosely carried the disk 31. This disk carries an adjustable eccentric 32. To enable the eccentric to be adjusted I form its bearing 33 on a slide 34 adjustable in the guideway 35 by means of the adjusting screw 36 the head of which is accessible through the rim of the disk. An index finger 37 is secured to the slide 34, extends through a slot 38 in the disk and serves to indicate the adjustment of the eccentric. A slot 39 must be provided in the slide 34 and bearing 33 for the passage of the shaft 5. This eccentric 32 is pivotally connected with the rock arm 40 secured to a spindle 41 journaled in the disk 27 and having secured to its other end a segmental rack 42 meshing with the differentiating gear wheel 26. By the rotation of the disk 27 which rotates with the shaft 5 the differentiating gear wheel will rotate with the shaft. It is evident however that by rocking the rack 42 in one direction that this speed may be accelerated and that by rocking the rack in the opposite direction this speed may be retarded. This rocking of the segmental rack it may be seen is accomplished by the action of the eccentric 32 the direction of motion of the rack and consequently the acceleration or retardation of the motion of the differentiating gear wheel depends on whether the pinion 30 is in mesh with the differentiating gear when the rack is rocking forward or when it is rocking backward. This disk is driven in the following manner. A gear wheel 43 is secured thereto. This gear wheel meshes with a pinion 44 fast on the spindle 45 journaled in the frame of the machine. The other end of this spindle is provided with a pinion 46 meshing with the intermediate gear wheel 47 journaled on the disk 48 rotatable about the shaft 5 and adapted to be clamped in place by the clamping screw 49 which preferably also forms the bearing for the intermediate gear 47 and has a head 76 working in a slot 77 in the frame.

Secured to the shaft 5 is a pinion 50 meshing with the intermediate gear. By this arrangement of gearing the disk 31 is rotated in the opposite direction to the shaft 5 and consequently the segmental rack 42 is actuated to periodically accelerate the speed of the differentiating gear wheel 26. Now the pinion 30 must be brought into engagement with the driven gear wheel 22 and the differentiating gear wheel 26 at such times as the eccentric starts to move the segmental rack 42 to accelerate the differentiating gear wheel and the pinion 30 must be brought into mesh with the driven gear wheel 22 and the normal speed gear 25 as soon as acceleration ceases. To effect this movement I provide the following mechanism: 51 is a rack adapted to slide in the guideway 75 carried by the disk 27. Projecting from the rack is a pin 52 engaging the cam 53 formed on the disk 31. The rack 51 meshes with the pinions 54 on the spindles 55 journaled in the guideway 75. These spindles have loose on their outer ends the pinions 56, each pinion provided with a notch in its outer face adapted to engage the pin 57 on the spindle. The spindles are longitudinally movable in the guideway 75 and at their other ends are provided with annular grooves 58, 59. On the guideway is carried a plate 60 provided with a pin and slot connection 61 so that it may be adjusted to and from the spindles 55 to engage either the groove 58 or 59. It is evident that by adjusting the spindles 55 lengthwise they may be held as adjusted, by means of the plate 60, with either one or the other in driving connection with its pinion 56. These pinions 56 engage opposite sides of the double rack 62 on which the pinion 30 is journaled and which is adapted to slip over the guide pin 29 as shown particularly in Fig. 3. The purpose of this method of

moving the pinion 30 will shortly appear. For the present, suffice it to say that the outer pinion 56 is in clutch with its spindle 55 when the mechanism is set as shown in the drawings and the disk 31 is rotating in the opposite direction to the shaft 5. The pinion 30 is thus alternately moved back and forth by the engagement of the pin 52 with the cam 53.

It will now be in place to explain the object of rotating the disk 31 carrying the eccentric 32 and cam 53. It will be understood that the printing and non-printing parts of each rotation of the printed cylinder must take place in equal periods of time, and as the speeds are not the same during printing and non-printing the revolutions of the printing cylinders do not correspond to the revolutions of the drive shaft. Consequently if the differentiating gear wheel be accelerated at equal periods of time relative to the rotation of the drive shaft the desired result of having the acceleration occur at equal intervals relative to the rotation of the printing cylinders could not be attained. Consequently the disk 31 cannot be held stationary but must be moved backward relative to the rotation of the drive shaft to cause acceleration to take place a little earlier relative to each rotation of the drive shaft, if the differentiating gear wheel is to be given an accelerated movement.

The gearing between the drive shaft and disk 31 must be properly proportioned and the eccentric suitably adjusted to cause the pinion 30 to shift exactly when the speed of the driven gear wheel 22 is to be changed from normal to differentiated and vice versa.

Now, the utility of the machine depends on its ability to turn out work of different lengths without waste of paper, consequently the mechanism must be adjustable. If the arc during which printing takes place is short the arc during which acceleration takes place must be long. A large arc of acceleration is obtained by increasing the eccentricity of the eccentric 32 and as this increases the disproportion between the number of rotations of the drive shaft and the printing cylinders the gearing between the drive shaft and the disk 31 must be changed to move the cam backward sufficiently to cause the acceleration to occur each time at the proper place. This change of gearing may be readily obtained by removing the pinion 46 and replacing it with another of the necessary size to produce the desired effect. The disk 48 must of course be adjusted to cause the intermediate gear 47 to properly mesh with the larger pinion 46. Any means may be provided for making the pinion 46 removable. I show, however, the pinion 46 as being provided with a notch 63 adapted to engage a pin 64 on the spindle 45. A slotted collar 65 is held in place on the end of the spindle 45 by means of a nut 66. By loosening the nut the collar may be removed and the pinion 46 slipped off for changing.

The impressions of the cylinders as the machine is arranged take place simultaneously. It follows, however, from the fact that as the arc through which the printing movement of each printing cylinder takes place may be varied and as the accelerated motion takes place in the same space of time as the normal motion of rotation, that, when the accelerated arc is large and the printing arc small, smaller printing plates may be employed and that the impression of each printing cylinder will be shorter in length and follow at shorter intervals. Consequently in order that the second printing cylinder may accurately fill in the gaps left by the other printing cylinder it is necessary that there shall be more or less paper between the two printing cylinders according to the adjustment of the machine. I make this adjustment by causing the paper to follow a longer or shorter path as may be necessary. For this purpose I provide stationary guide rollers 67 one on each side of the roller 12. The roller 12 is journaled in the slides 68 movable in the guides 69. Each slide is formed as a rack and these racks are engaged by the pinions 70 fast on the spindle 71 journaled on the frame of the machine and provided with a hand wheel 72. A clamping nut 73 is screwed on the end of the spindle 71 and engages the frame to hold the slides as adjusted.

The object in using a retarded speed during the non-printing part of each revolution of the machine is to enable me to employ printing segments of over 180 degrees of arc. I arrange the machine to obtain this differentiated speed by swinging the disk 48 to withdraw the intermediate gear 47 from engagement with the pinion 46. On the disk 48 is journaled a second intermediate gear wheel 74 meshing with the gear wheel 47 and by swinging the disk around until this second intermediate gear meshes with the pinion 46 a movement of the cam disk 31 in the same direction as the shaft 5 is obtained. The pinion 30 is thus brought into mesh with the differentiating gear wheel 26 when the segment 42 is rocking backward and a retardation of its motion is obtained. As the number of revolutions of the printing cylinders is now less than the revolutions of the drive shaft retardations must take place at intervals of time greater than represented by revolutions of the shaft and the forward rotation of the cam 53 carried by the cam disk 31 causes the meshing of the pinion 30 with the driven gear 22 and the differentiating gear 26 to occur a little later each revolution of the drive shaft. Of course, as the eccentric 32 moves with the disk 31 the retarding movement of the seg-

mental rack 42 is also properly timed. By the adjustment of the machine different lengths of printing segments over 180 degrees are obtained as before by adjusting the eccentric 32 and changing the gear pinion 46. When, however, the printing cylinders are retarded during the non-printing part of each rotation it is necessary to place the inner spindle 55 in clutch with its pinion 56 and to throw the outer spindle out of engagement with its pinion since the shifting movement must take place just when the segmental rack 42 is about to commence its backward movement and the inner pinion 56 has the proper movement to effect this.

The mechanism described I find effectively accomplishes the object of my invention. The printing cylinders rotate at a uniform speed during the printing part of each rotation and consequently they coöperate satisfactorily with the paper which can only successfully be fed at a uniform rate of speed.

With my mechanism the speed of the printing cylinders during the printing remains the same no matter what the adjustment of the machine may be within its limits, so that there is no necessity to provide any means of varying the rate of feed of the paper and the output of the machine in superficial area of printed service will remain substantially the same at all adjustments. This is something not heretofore accomplished as far as I am aware. The impression cylinder also being geared to the printing cylinder revolves synchronously therewith and thus the same part of an impression cylinder will always coöperate with a given part of one of the printing segments. This is important in printing as it is usually necessary to pad certain portions of the impression rollers to produce uniform imprints.

It will be understood that instead of stereotypes or electrotypes that perforating and dividing or other impression features may be employed.

It must also be understood that I use the term "gear" when applied to the wheels 22, 25 and 26 in its broadest sense. These need only be toothed as far as called for by their relationship to the pinion 30 and naturally equivalent constructions might be substituted therefor.

What I claim as my invention is:—

1. In a rotary printing press provided with rotatable printing means; means for imparting a variable rotary motion to the printing means comprising a driving shaft; a normal-speed gear rotating with said shaft; a driven gear having a driving connection with the rotatable printing means; a differentiating gear; means for alternately driving the driven gear from the normal speed gear and from the differentiating gear at equal intervals of time; and means for driving the differentiating gear at a different speed to the drive shaft when the driven gear is actuated from said differentiating gear.

2. In a rotary printing press provided with rotatable printing means; means for imparting a variable rotary motion to the printing means comprising a driving shaft; a normal-speed gear rotating with said shaft; a driven gear having a driving connection with the rotatable printing means; a differentiating gear; means for alternately driving the driven gear from the normal speed gear and from the differentiating gear at equal intervals of time; and means for driving the differentiating gear at a different speed to the drive shaft when the driven gear is actuated from said differentiating gear comprising an eccentric actuated from the shaft; a rack engaging the differentiating gear, and driving connections between the eccentric and the rack.

3. In a rotary printing press provided with rotatable printing means, means for imparting a variable rotary motion to the printing means comprising a driving shaft; a normal-speed gear rotating with said shaft; a driven gear having a driving connection with the rotatable printing means; a differentiating gear; shiftable means for giving the driven gear a driving connection with either the normal-speed gear or the differentiating gear; shifting means for moving said shiftable means; a cam loose on the shaft adapted to actuate said shifting means; gearing between the shaft and the cam adapted to rotate the cam to cause the shifting means to operate at equal intervals of time; and means for driving the differentiating gear at a different speed to the shaft at such times as it is in driving connection with the driven gear.

4. In a rotary printing press provided with rotatable printing means, means for imparting a variable rotary motion to the printing means comprising a driving shaft; a normal-speed gear rotating with said shaft; a driven gear having a driving connection with the rotatable printing means; a differentiating gear; shiftable means for giving the driven gear a driving connection with either the normal-speed gear or the differentiating gear; shifting means for moving said shiftable means; a cam loose on the shaft adapted to actuate said shifting means; gearing between the shaft and the cam adapted to rotate the cam to cause the shifting means to operate at equal intervals of time; and means for driving the differentiating gear at a different speed to the shaft at such time as it is in driving connection with the driven gear, comprising an eccentric rotating with the cam, a rack engaging the differentiating gear, and driving connections between the eccentric and the rack.

5. In a rotary printing press rotary printing means forming a segment of a cylinder in combination with means for driving said printing means at a uniform speed during the printing part of each rotation and at a different speed during the non-printing part of each rotation; and means for making the differentiated speed either an acceleration or a retardation of the printing speed, at the will of the operator.

6. In a rotary printing press provided with rotatable printing means, means for imparting a variable rotary motion to the printing means comprising a driving shaft; a normal-speed gear carried by and rotating with said shaft; a driven gear loose on said shaft and having a driving connection with the rotatable printing means; a differentiating gear loose on said shaft; shiftable means for giving said gear an operative engagement with either the normal-speed gear or the differentiating gear; a cam loose on the shaft adapted to actuate said shiftable means; gearing between the shaft and the cam adapted to rotate the cam to cause the shifting means to operate at equal intervals of time; an eccentric rotating with said cam; and means whereby the eccentric actuates the differentiating gear.

7. In a rotary printing press provided with rotatable printing means, means for imparting a variable rotary motion to the printing means comprising a driving shaft; a normal-speed gear rotating with said shaft; a driven gear having a driving connection with the rotatable printing means; a differentiating gear; shiftable means for giving the driven gear a driving connection with either the normal-speed gear or the differentiating gear; shifting means for moving said shiftable means; a cam loose on the shaft adapted to actuate said shifting means; gearing between the shaft and the cam adapted to rotate the cam to cause the shifting means to operate at equal intervals of time; means for varying the said gearing to rotate the cam at different speeds; and means for driving the differentiating gear at a different speed to the shaft at such times as it is in driving connection with the driven gear comprising an eccentric rotating with the cam, means for varying the eccentricity of the eccentric, a rack engaging the differentiating gear, and driving connections between the eccentric and the rack.

8. In a rotary printing press provided with rotatable printing means, means for imparting a variable rotary motion to the printing means, comprising a driving shaft; a normal-speed gear carried by and rotating with said shaft; a driven gear loose on said shaft and having a driving connection with the rotatable printing means; a differentiating gear loose on said shaft; shiftable means for giving said driven gear an operative engagement with either the normal-speed gear or the differentiating gear; a cam loose on the shaft adapted to actuate said shiftable means; gearing between the shaft and the cam adapted to rotate the cam to cause the shifting means to operate at equal intervals of time; means for varying the said gearing to rotate the cam at different speeds; an eccentric rotating with said cam; means for varying the eccentricity of the eccentric; and means whereby the eccentric actuates the differentiating gear.

9. In a rotary printing press provided with rotatable printing means, means for imparting a variable rotary motion to the printing means comprising a driving shaft; a normal-speed gear carried by and rotating with said shaft; a driven gear loose on said shaft and having a driving connection with the rotatable printing means; a differentiating gear loose on said shaft; shiftable means rotating with the shaft for giving said driven gear an operative engagement with either the normal-speed gear or the differentiating gear; a cam loose on the shaft adapted to actuate said shiftable means; gearing between the shaft and the cam adapted to rotate the cam to cause the shifting means to operate at equal intervals of time; means for varying the said gearing to rotate the cam at different speeds in either direction; an eccentric rotating with said cam; means for varying the eccentricity of the eccentric; and means whereby the eccentric actuates the differentiating gear.

10. In a rotary printing press provided with rotatable printing means; means for imparting a variable rotary motion to the printing means comprising a driving shaft; a normal-speed gear rotating with said shaft; a driven gear having a driving connection with the rotatable printing means; a differentiating gear; means for alternately driving the driven gear from the normal speed gear and from the differentiating gear at equal intervals of time; means for driving the differentiating gear at a different speed to the drive shaft when the driven gear is actuated from said differentiating gear; means for lengthening and shortening the aforesaid intervals of time relative to the rotations of the driving shaft; and means for correspondingly varying the driving speed of the differentiating gear.

Toronto, this 16th day of August, 1910.

LOUIS HUFFMAN.

Signed in the presence of—

J. EDW. MAYBEE,

E. P. HALL.