C. A. KELLOGG.

PRINTING MACHINE.

APPLICATION FILED DEC. 15, 1919.

1,411,788. Patented Apr. 4, 1922.

3 SHEETS—SHEET 1.

Fig. 1,

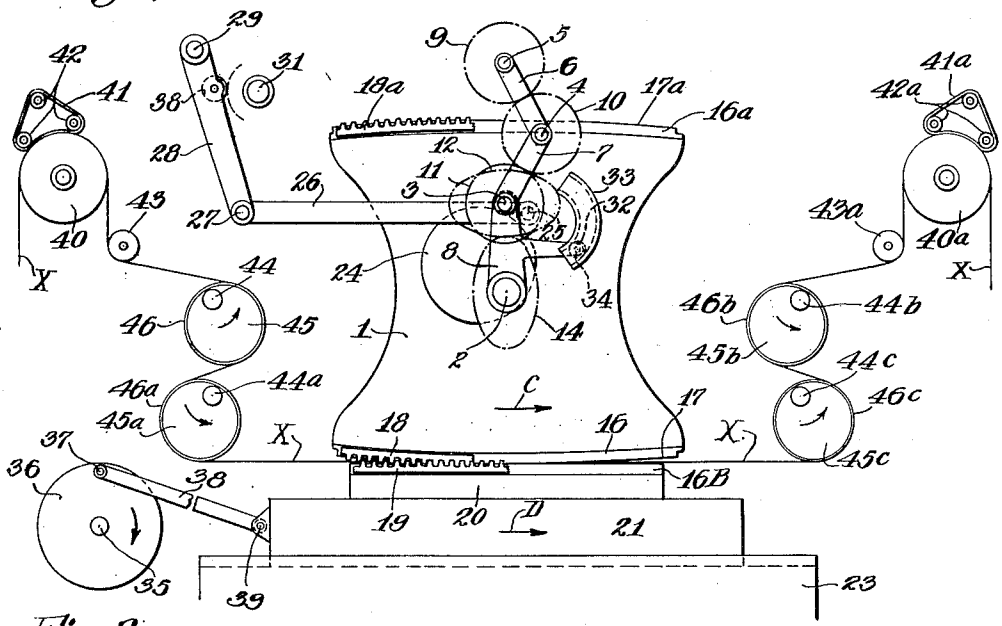


Fig. 2,

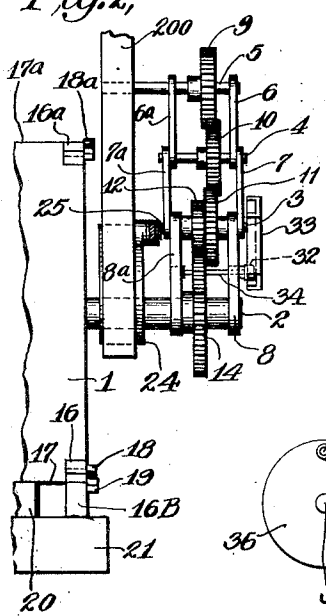
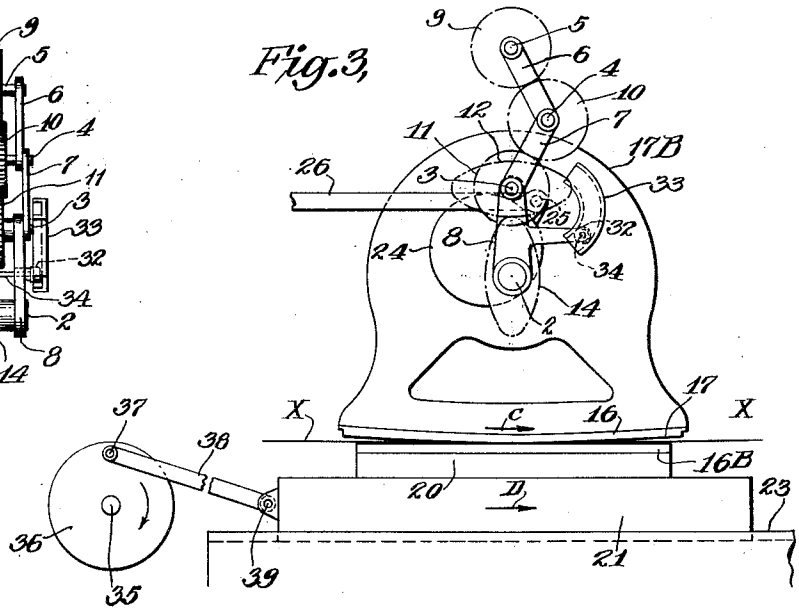


Fig. 3,



Inventor

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By his Attorney

Jas. H. Griffin

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3 SHEETS—SHEET 2.

Fig. 4.

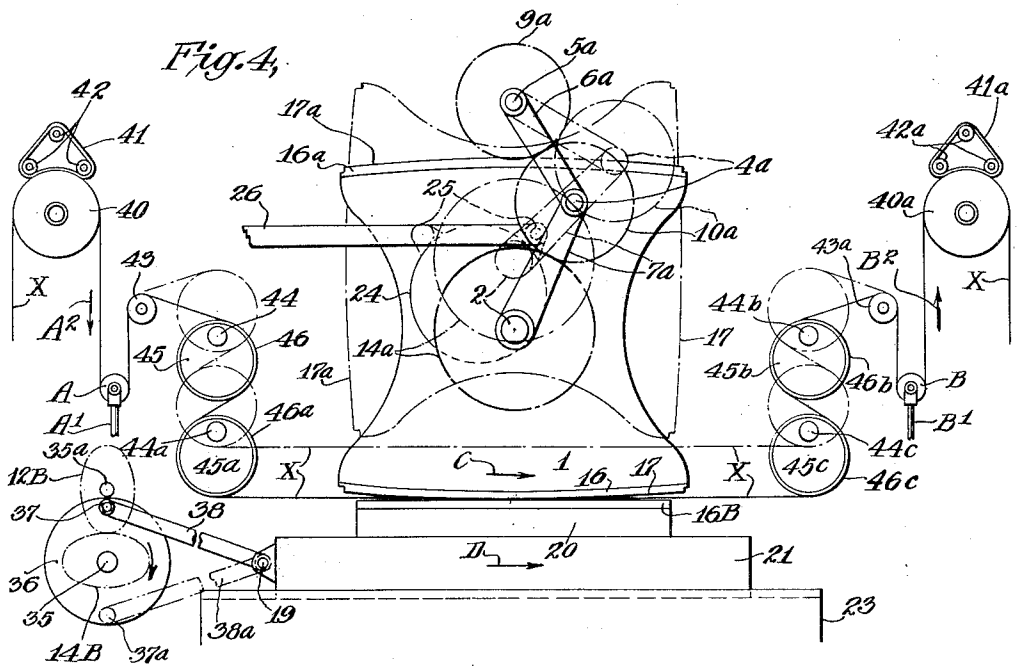
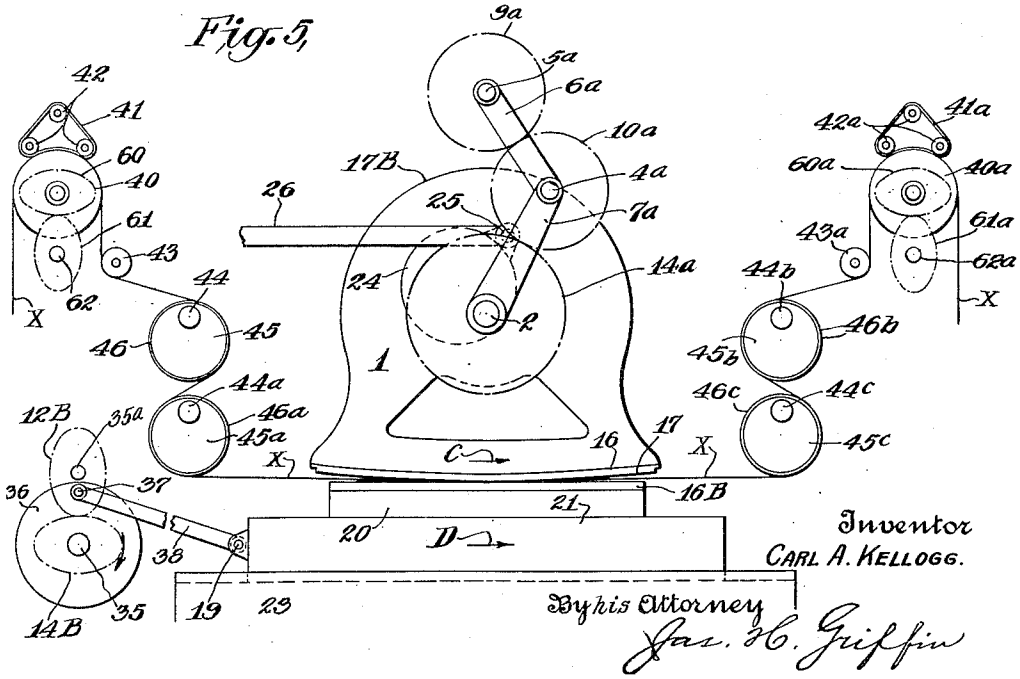


Fig. 5.



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3 SHEETS—SHEET 3.

Fig. 6,

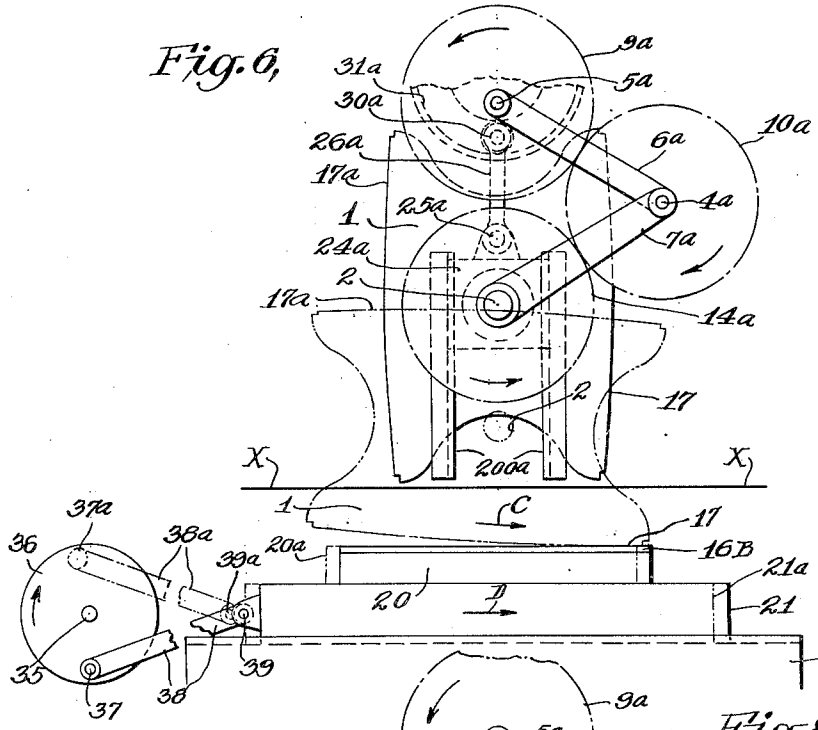


Fig. 7,

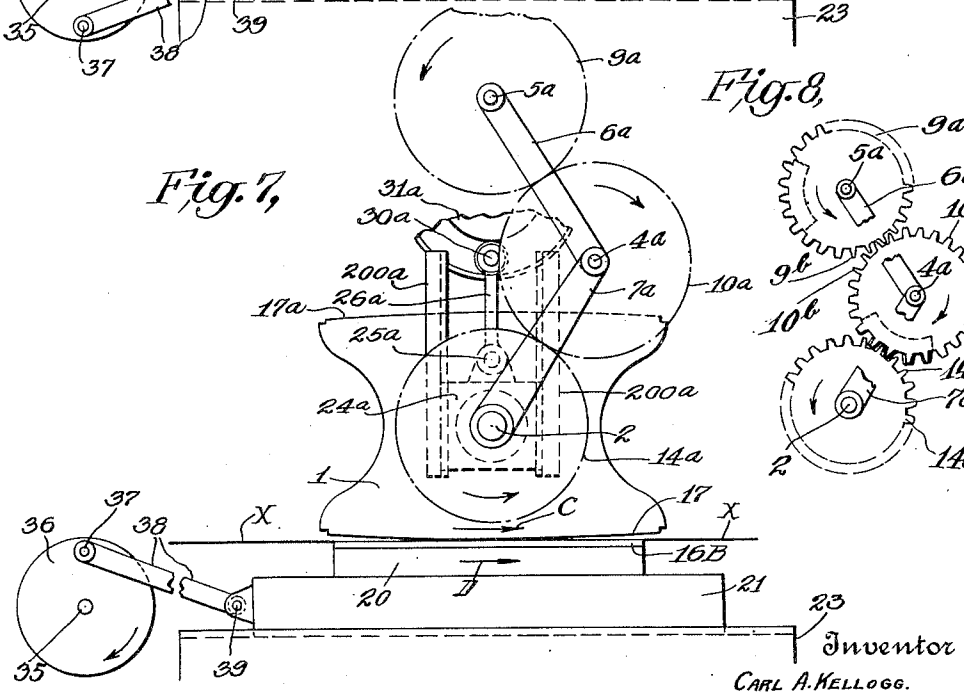


Fig. 8,

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UNITED STATES PATENT OFFICE.

CARL A. KELLOGG, OF BROOKLYN, NEW YORK.

PRINTING MACHINE.

1,411,788. Specification of Letters Patent. Patented Apr. 4, 1922.

Application filed December 15, 1919. Serial No. 344,955.

To all whom it may concern:

Be it known that I, CARL A. KELLOGG, a citizen of the United States, residing at New York city, borough of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Printing Machines, of which the following is a specification.

This invention relates to certain improvements in printing machines, and more particularly in that class or type of such machines in which one member of a printing couple, including members one of which is capable of supporting a flat form is employed and the other member of the printing couple having a curved impression surface, is capable of movement about a center, one member being so actuated or moved that it will take an impression from the form in a very slight part of its total movement.

The invention further embodies in a printing machine wherein a member, having a curved impression surface, is supported eccentrically with respect thereto and has actuating means for moving or rotating said member upon its supports in such manner as to maintain a line contact across the coacting form throughout the period of impression.

The invention also embodies a printing machine of this general character wherein one member of the printing couple is rotated or moved around a support that is positioned eccentrically to its impression surface.

A further feature of the invention resides in a rotary web manipulating device which is capable of operation to lift the web from the form between impressions.

The invention also, consists, in part, in the provision of means for balancing an impression member to the end that it may be actuated at high speed without undue jar or vibration.

Features of the invention, other than those specified, will be apparent from the hereinafter detailed description taken in conjunction with the accompanying drawings.

In the accompanying drawings I have illustrated different practical embodiments of the invention, but the constructions therein shown are to be understood as illustrative only, and not as defining the limits of the invention.

Figure 1 is a diagrammatic side elevation of the operating parts of the printing machine embodied in the present invention.

Figure 2 is a fragmental end elevation of the printing couple showing the driving connections at one side of the machine for actuating the platen.

Figures 3, 4 and 5 are views similar to Figure 1, but illustrating modified forms of the invention.

Figures 6 and 7 are views similar to Figure 1, but illustrating a further modified form of the invention with the members of the printing couple off and on impression; and

Figure 8 is a detailed showing of the gearing for actuating the movable member of the printing couple shown in Figures 6 and 7.

Referring to the drawings and more particularly to Figures 1 and 2, wherein the preferred embodiment of the invention is illustrated, 1 designates the platen or impression member of the machine and 20 the form, which in accordance with the present invention, is mounted on a form bed 21 in turn mounted for sliding or reciprocating movement in guides 23 positioned at the opposite lateral edges thereof. The form bed is reciprocated in the guides 23 by crank disks 36 carried by a shaft 35 and have off-center wrist pins 37 each of which is associated with one end of a connecting rod 38, the opposite end of which is connected at 39 to the form bed. As the crank disks 36 rotate, the form bed, with its superimposed form, is reciprocated back and forth, in this form of the invention at a substantially uniform speed, during the period of impression beneath the impression member 1 of the printing couple.

The impression member 1 is shown in Figure 1 as embodying two curved impression surfaces 17 and 17ª and the impression member mounted to revolve in an eccentric path for the purpose of bringing the impression surfaces alternately into co-operative relation with the form, and in order to obtain the proper line engagement between the members of the printing couple while on impression, both the impression surfaces 17 and 17ª are formed on an eccentric curve. The means for mounting and actuating the impression member 1 and the manner in which it co-operates with the form will now be described.

Mounted for rotation in the framing 200

of the machine is an eccentric 24 (see Figures 1 and 2) and extending through said eccentric is a shaft 2 which extends into and is secured to the impression member 1 at the center thereof. The shaft 2 thus carries and supports the impression member 1 in the frame 200, but is rotatably mounted within the eccentric 24. It may be noted here that the means for supporting and rotating the platen is preferably duplicated at the opposite sides of the machine.

Rotation is imparted to the platen through a train of gears 9, 10, 11, 12 and 14, the latter of which is fixed on the shaft 2, the gears 9 and 10 being fast on shafts 5 and 4 and the gears 11 and 12 being fast on shaft 3, all is clearly shown in Figure 2. The shaft 5 is mounted for rotation in the upper ends of arms 6 and 6^a and in the frame 200. The shaft 4 is mounted for rotation in the lower end of arms 6 and 6^a and the upper ends of arms 7 and 7^a, and the shaft 3 is revolvably mounted in the lower ends of arms 7 and 7^a and the upper ends of arms 8 and 8^a.

In this embodiment of the invention, both the web X and the form bed 21 move at substantially a constant speed during impression, the speed of both of these parts being the same during this period. It is desirable that the impression surface of the platen move at the same speed during impression, but as the portions of the impression surface which begin and end impression are a greater distance from the center of the platen than the intermediate portion thereof. Accordingly, if the platen were operated at a constant speed, the impression surface would not travel at the same speed as the web and form bed throughout impression. To this end, the gears 12 and 14 are elliptical, as shown, and are so arranged as to drive the platen with decreasing speed from beginning to the middle of impression and with increasing speed from the middle to the end of impression.

The gear 9 is preferably the driven gear from which initial movement is imparted and drives through the gear trains referred to, to rotate the impression member, but the construction of arms or links specified is such that the gearing as allowed is retained in mesh at all times irrespective of the movements of the impression member off and on impression. The arms 8 and 8^a are connected together by a bracing shaft 34 which carries the roller 32 operating in a curved guide 33 fixed on the frame of the machine and this means serves to maintain the arms 8 and 8^a in upright, parallel directions at all times during the operation of the impression member.

Not only is the impression member rotatable with the shaft 2, but is also adapted to be raised and lowered in an arcuate path through the rotation of eccentrics 24 in which the shaft 2 is journalled.

To this end each eccentric 24 is operatively connected as at 25 to connecting rod 26 the opposite end of which is connected at 27 to an arm 28 pivoted at 29. Each arm 28 carries a roller 38 actuated by a suitable cam on a shaft 31. The shaft 31 is driven in timed relation to the shaft 2 with the result that the eccentric 24 at the commencement of each impression will be moved to cause the impression member to be lowered to the center of impression and then to raise the member 1 to the end of the impression thereby maintaining a line contact throughout the entire length of impression. At the termination of impression the eccentric, continuing to move will lift the member 1 clear from the form and web X on which the printing is taking place to allow of the shifting of the web in the manner hereinafter described.

The web X is continuously fed into and out of the machine at a substantially uniform speed by in-feed and out-feed rollers 40 and 40^a and tapes 41 and 41^a which are passed around rollers 42 and 42^a as shown in Figure 1. The web is supplied from a roll, not shown, and passes between roller 40 and tapes 41 thence under guide roll 43 to and around the web lifting eccentrics 45 and 45^a. The web is then led between the members of the printing couple to and around the complementary lifting eccentrics 45^c and 45^b, thence under guide roll 43^a and over the outfeed roll 40^a.

The operation of the machine as shown in Figure 1 will now be described.

Assuming that the parts are in the positions shown in Figure 1, with the gear train and eccentric 24 actuating the platen 1, and the crank disks 36 reciprocating the form bed, the impression of the form 20 will take place midway of that stroke of the bed which conforms with the direction of travel of the web. The length of time required to complete the impression depends upon the curvature of the impression surfaces 17 and 17^a. For example, if the curvature be such that when the impression member 1 is at the center of impression as shown in Figure 1 and each end or side is one half inch above the form, it will require but one half inch movement of the form to complete the impression from that point, and, of course, the same amount of movement from the beginning of impression to the center, making the total movement of the form one inch to take the impression of the entire form regardless of its length or width. As the impression member descends into engagement with the web on the form bearers 16 and 16^a formed on both edges of the impression member will bear upon similar bearers 16^b juxtaposed on the form bed and these co-

operating bearers of the platen and form bed are further preferably provided with co-operating racks, racks 19 being positioned on the form bed and racks 18 and 18ª mounted on the impression member. These racks will engage during the rolling co-action of the impression member on the form and will preclude slipping of said impression member.

When the impression member descends into engagement with the form, these parts are so synchronized that the right hand portion of the impression surface 16 will engage in line contact with the right hand portion of the form 20 and as the impression member is moved through the rocking of the eccentric described, the form bed 21 will be reciprocated in time relation to such operations by the crank disk 36, causing the line contact between the impression member and form to travel rapidly toward the right and carry out the impression. As soon as the impression is completed, the connecting rod 26 operates on the eccentric 24 to lift the impression member free from engagement with the form and web and then rock the eccentric back to bring the impression surface 17ª into co-operative relation with the form bed for the start of the next impression.

During this interval when the members are off impression the web lifting and lowering devices 45, 45ª, 45ᵇ, and 45ᶜ are operating through any suitable form of mechanism not shown to strip the web from the from and maintain it free from the impression member. They also serve to time the movement of the web during impression. These web lifting and lowering devices are constructed to be continuously rotated by any suitable gearing fixed to shafts 44, 44ª, 44ᵇ and 44ᶜ so that each pair of lifting and lowering rolls will rotate together in the directions of the arrows. The shafts which carry these rolls are suitably mounted in the framing of the machine and are positioned off center in their respective rolls, so as to make these rolls, in effect, eccentrics, and around the several rolls are roller sleeve 46, 46ª, 46ᵇ and 46ᶜ, which are revolvably mounted upon the rolls and are free to rotate so as to be revolved by the web at such times as it would have a tendency to travel at slightly different speeds from the lifting and lowering rolls.

As shown in Figure 1, one pair of the eccentric lifting rolls 45 and 45ª have not reached their lowest point while the other pair 45ᵇ and 45ᶜ have passed their lowest point. By positioning the respective rolls in this manner the web will be allowed to follow the curvature of the impression surface from the beginning of the impression to its completion and thereby strip the web gradually from the form, and when they are later raised to the position shown in dot and dash lines in Figure 4, the web lifting devices will take a corresponding position or nearly so as all of the devices are shown both down and up in this figure.

In carrying out the operations described in the making of an impression, the impression member 1 is rotated at different speeds through the employment of the elliptical gears 12 and 14. As stated, these gears are preferably so shaped and proportioned that they will cause the impression surfaces 17 and 17ª to travel at a speed that conforms with that of the web and form during the time that they are all in contact on impression. In order to obtain proper time relation of operations between the impression member and the form member, the speed of rotation of the shafts 2 and 35 may be made in the ratio of one to two so that the member 1 will make one revolution to two of the crank disk 36. This will cause perfect synchronism of operations.

In the modified form of the machine shown in Figure 3, the structure is substantially the same as that shown in Figure 1, with the exception that impression member is timed to make but one revolution to one of the crank disks 36, the reason for which is obvious when it is noted that the impression member of Figure 3 has but one impression surface 17. The construction of the member 1 is such that it will have a part 17ᵇ which will act to balance the impression member and overcome vibration. The eccentric 24 will be actuated to raise and lower the member 1 but once during a complete rotation of the same instead of twice as in Figure 1.

In the machine shown in Figure 4, the structure is modified so that the web is fed into and out of the machine continuously by feed rollers 40 and 40ª and is speeded up to conform to the speed of the impression member which operates at a constant speed during impression, by looping rolls A and B, moving in the direction of the arrows A^2 and B^2 at the time of taking impression. The rolls A and B are supported on rods A′ and B′ and may be moved by any suitable means such as by cams or suitably operated rocker arms, not shown. The action of these rolls will be such that the web will be moved ahead in the direction with the bed at the time of taking the impression, at a speed conforming to that of the bed and during intervals between impressions will act to slow down the web so that properly spaced impressions will be produced through a reversal of movement of the looping rolls.

The construction and operation of the web lifting eccentrics 45, 45ª, 45ᵇ, and 45ᶜ in the machine of Figure 4 is substantially the same as described with reference to Figure 1 and will act to keep the web clear and free

from contact with the impression surfaces and with the form in intervals between impressions as clearly shown in dot and dash lines in which the web is shown in its raised position and the eccentrics are also shown in raised position. It may be noted here that these eccentrics 45–45^c in the construction of Figure 1 as well as in the construction of Figure 4 lift the web and at the same time act to change the run of the web between the printing couple, and will maintain the same length of web between these rollers, 43 and 43^a.

In the construction of Figure 4, the crank disks 36 will be driven at a variable speed instead of at a constant speed as in Figure 1, by elliptical gears 12^b and 14^b. These gears are fast on shafts 35^a and 35 respectively and are so shaped and proportioned as to cause the bed 21 to be driven at the same speed as that of the impression member and the web during the intervals of impression. The bed will be slowed down midway of its stroke and speeded up near the terminii of impression. The connecting rods 38 are shown in dot and dash lines 38^a in the position they take at the time when the impression member is in the position shown in the dot and dash lines.

The impression member in this embodiment of the invention will be actuated by an eccentric 24 in the same manner as described with reference to Figure 1, but will be rotated at a given speed by the gears 9^a, 10^a and 14^a instead of through elliptical gears 12 and 14 as in Figures 1, 2 and 3. The gears 9^a and 10^a are supported in arms 6^a and 7^a in a manner similar to the arms 6, 6^a, 7 and 7^a and the gears 10^a and 14^a will take the position shown in dot and dash lines in Figure 4, as will also the arms 6^a and 7^a. In Figure 4, the intermediate position of the impression member when off impression is also shown in dot and dash lines.

In the modified form of construction shown in Figure 5, the web is fed into and out of the machine at a variable speed conforming to that of the members of the printing couple, during the time of impression through the employment of elliptical gears 60, 61, 60^a and 61^a which serve to drive the feed rollers 40 and 40^a. These elliptical gears are so shaped and proportioned as to cause the web to travel at a speed conforming to the speed of the members of the printing couple during intervals of impression instead of by using the looping rollers shown and described in Figure 4 for the same purpose.

The printing couple, i. e. both the impression and form members will be operated in the same manner as described with reference to Figure 4 and embody substantially the same construction except that the impression member in Figure 5 has but one impression surface whereas in Figure 4 it is shown as embodying two impression surfaces.

Figures 6 and 7 illustrate a still further modified form of the invention, wherein the members of the printing couple are moved together at substantially the same speed as well as the web during the time or interval of taking the impression. In this construction, the impression member is rotated or moved half way around while the bed is reciprocated forward and back. The impression member will make one revolution to two of the crank disks 36 and the web may be fed into and out of the machine and raised and lowered after the manner shown and described with reference to Figure 1. In Figures 6 and 7, the shaft 2 is shown as positioned at a point which causes the impression surfaces 17 and 17^a, when rotated by gears 9^a, 10^a and 14^a, to alternately come into printing relation with the form upon the bed to produce properly spaced impressions upon the web, while said impression member is rotated at a substantially constant speed. In Figure 6, the member 1 is shown in full lines when raised to its highest point off impression, and in dot and dash lines at the beginning of the impression. The bed 21 is shown in full lines in the position it takes relative to the member 1 in full lines and in dot and dash lines in the position it takes as the impression member commences impression.

The shaft 2 which carries the impression member is mounted for rotary movement in a movable bearing 24^a which is slidably mounted for movement toward and away from the form bed in the framing 200^a of the machine. The bearings 24^a are raised and lowered in the guides of the framing to produce substantially the same result as that of the eccentric 24 in the other forms of the invention, namely, to move the member 1 off and on impression and cause the impression surfaces 17 and 17^a to maintain a line contact with the form during impression. The bearings 24^a are raised and lowered by cams indicated at 30^a connected to the bearings 24^a at 25^a by links 26^a. Cam 30^a rides on the cam face 31 which controls the raising and lowering of the impression member. The impression member is rotated through gearing 9^a, 10^a and 14^a which is mounted in the same manner as described with reference to Figs. 4 and 5, but it will be noted that each of said gears are provided, but a short distance, with teeth 9^b, 10^b and 14^b, respectively, which are smaller than the remaining teeth of the gears. This construction serves the same purpose of the use of elliptical gears although not so efficiently. In other words, both the web and the bed travel at substantially the same uniform speed during impression. The small teeth allow

the platen to slow up at the beginning and at the end of impression so that all parts of its impression surface will travel at the same speed as the web.

In this embodiment of the invention, the impression member will be raised and lowered in the slide bearing 24ª in a straight line instead of in a curved path as in the previously described embodiments of the invention.

From the foregoing description of my invention it will be apparent that a printing machine constructed in accordance therewith is a comparatively simple and exceedingly compact construction and is particularly well adapted for use in printing the better grades of work at high speed, as well as for printing newspapers from flat forms. It will be further apparent to those skilled in the art that the machine described is capable of being operated at high speed without undue stress being imposed upon the web or on the machine. In the accompanying drawings, I have illustrated several forms of the invention but it will be understood that the same is capable of considerable modification without departure from the scope and spirit of the invention and accordingly I do not desire to be understood as limiting myself to the precise forms and arrangement of the several parts herein set forth in carrying out my invention in practice.

For example, in some instances, the impression member may be reciprocated and rotated at the same time around its center to complete the impression in the same time even though the curved impression surface is of a similar circumference as that shown. It is also within the scope of the invention to raise and lower the form into and out of printing relation with the impression member, in which instance it would not be necessary to raise the impression member, the web lifting eccentrics serving to keep the web free from the members of the printing couple between impressions, or both members of the printing couple may be moved toward and away from one another, the one raised and lowered to move off and on impressions and the other lowered to allow of the inking of the form. In this case, the web lifting eccentrics can be dispensed with.

It will be manifest from the foregoing description of the invention that all of the forms thereof have the aim, among other aims, to synchronize the movements of the platen, form member and web during periods of impression so that they will travel at the same speeds. In the construction of Figures 1, 2 and 3, the web moves at a constant speed during impression and the same may be said of the form bed 21, but the platen is adapted for variable speeds through the elliptical gears described so that the impression surfaces of the platen will conform to the speed of the web and bed. In the construction of Figure 4, the platen moves at a constant speed, the bed is operated at various speeds by the elliptical gears and the movement of the web at variable speeds, is controlled by looping rollers. The effect is the same as in Figs. 1 to 3, in that all of the parts move at uniform speeds during impression. In Figure 5, the platen operates at a constant speed while the speeds of the web and form bed are variable as controlled by elliptical gears as pointed out. In the construction of Figs. 6, 7 and 8, both the web and the form are operated at a constant speed during impression but loss motion is provided for in the gearing which drives the platen so that the speed of the platen may conform to the speed of the web and bed. Thus all the forms of construction shown are directed to the same end and other forms might have been added which would accomplish the same purpose but it is believed that the embodiments illustrated will suffice to give a clear conception of the invention.

I have not deemed it necessary to show mechanical movements for all of the different parts shown, exact shape of the cams for operating the eccentrics or the exact shape of the elliptical gears for actuating the parts with which they are associated, but have only described the operation of the parts so that any mechanic skilled in the art of plotting cams and gearing may readily lay out the cams and the proper gearing to accomplish the movements of the parts as described. In carrying out this invention the movement of the members of the printing couple may be accomplished by mechanisms which move them intermittently without departing from the broad spirit of the invention.

While I have shown my invention with but a single printing couple and one web, it will be understood that other printing couples may be added where it is desirable to print and perfect one or more webs in one or more colors.

It will be understood that changes in form and details, such as the substitution of equivalents, may be made in the structure described without materially departing from the invention, the scope of which is commensurate with the appended claims.

Having thus fully described the invention, what I claim as new and desire to secure by Letters Patent is:

1. In a printing machine, a printing couple embodying a movable flat bed adapted to support a flat form and a co-operating impression member having a curved impression surface, said impression member being

rotatable through 360 degrees on an axis eccentric to the curvature of its impression surface.

2. In a printing machine, a printing couple embodying a movable bed and a cooperating impression member having a curved impression surface, said impression member being bodily movable, and, also being rotatable through 360 degrees on an axis eccentric to the curvature of its impression surface.

3. In a printing machine, a printing couple both members of which move at the same speed during impression, means for feeding a web between said members and at the same speed of the members during the period of impression in combination with web lifting and lowering mechanism for maintaining the web free and clear of the members of the printing couple during the intervals between impressions and for properly positioning it during impression.

4. In a printing machine, a printing couple both members of which move at the same speed during impression and one of which has rotary movement, means for feeding a web between said members and at the same speed of the members during the period of impression, means for so operating the rotary member of the couple that impression is completed during a relatively small part of its rotary movement, in combination with web lifting and lowering mechanism for maintaining the web free and clear of the members of the printing couple during the intervals between impressions and for properly positioning it during impression.

5. In a printing machine, a printing couple embodying a pair of members, one of which is a movable bed and the other of which is an impression member having a curved impression surface, means for bodily moving the impression member through a continuous curvilinear path, and means for simultaneously rotating the impression member.

6. In a printing machine, a printing couple adapted to operate on an intermediate web, means for moving the web between the members of the printing couple at one speed during impression and at a different speed between impressions, and means for effecting bodily movement of both members of the printing couple in a direction longitudinally of the web and at the same speed as said web, while the printing couple is on impression.

7. In a printing machine, a printing couple adapted to operate on an intermediate web, said printing couple embodying form and impression members having substantially the same cooperating areas, means for synchronizing the operations of both the members of the printing couple and the web, whereby they all move in the same direction and at the same speed during impression, and means for effecting relative movement between said members to bring them off and on impression.

8. In a printing machine, a form member, an impression member having a curved impression surface, means for bodily moving the impression member through an endless curvilinear path, means for simultaneously rotating the impression member, means for reciprocating the form member, and the means for feeding the web between said members, both of said members being operated at the same speed during impression.

9. In a printing machine, a form member, an impression member having a curved impression surface, means for moving a web between said members, means for bodily moving the impression member through an endless curvilinear path to bring it alternately on and off impression, means for simultaneously rotating said impression member to effect impression through rolling coaction between said members, while on impression, the speed of the impression member being the same as that of the web during impression, and means for moving the form member at a speed harmonizing with that of the web during impression.

10. In a printing machine, a printing couple embodying a form and an impression member to operate on an intermediate web, means for effecting relative movement between said members to bring them on and off impression, means for moving both of said members at the same speed during impression, and means for moving the web at the same speed as the members during impression and at a decreased speed between impressions.

11. In a printing machine, a printing couple embodying form and impression members having cooperating surfaces of substantially the same area adapted to operate on an intermediate web, means for bodily moving one member toward and away from the other member to bring them on and off impression, means for moving both of said members at the same speed and in the same direction during impression, and means for moving the web at the same speed as the members during the period of impression.

12. In a printing machine, a form member, and a rotatable impression member having a plurality of curved impression surfaces all of which are eccentric to the axis of rotation of the impression member, means for bodily moving the impression member through an endless curvilinear path to move said member off and on impression, and means for simultaneously rotating the impression member to effect rolling co-action between the curved impression surfaces, in succession, and the form during successive impressions.

13. A platen for printing presses mounted for rotary movement and provided with a plurality of impression surfaces fixed with respect to one another each of which is curved eccentrically to the axis of rotation of the platen.

14. In a printing machine, a printing couple including an impression member and a form member, means for operating the members, and means operable to change the speed of one of said members during impression.

15. In a platen printing machine, an impression platen and a form bed, means for operating the platen and form bed, and means for changing the speed of the platen during the interval of impression.

16. In a printing machine, a movable flat form bed, and a rotatable impression member having a curved impression surface and rotating on a center below the center from which the curved impression surface is struck at the time of taking impression.

17. In a printing machine, a printing couple including a bed adapted to support a flat form, and an impression member having a curved surface, which impression member is mounted for rotary movement through 360 degrees on an axis positioned below the center from which said surface is struck.

18. In a printing machine, a printing couple including a bed adapted to support a flat form, and an impression member having a curved surface, which impression member is mounted for rotary movement through 360 degrees on an axis positioned below the center from which said surface is struck and means for intermittently moving the web between the bed and impression member.

19. In a printing machine, a printing couple including a bed adapted to support a flat form, and an impression member having a curved surface, which impression member is mounted for rotary movement through 360 degrees on an axis positioned below the center from which said surface is struck, and means for balancing the impression member so that it will be rotated without vibration.

20. A printing machine having a printing couple including a bed adapted to support a flat form and an impression member, means for feeding a web between the printing couple and rotatable means operable to move the web free from one member of said couple, said means rotating on an axis eccentric to the surface thereof.

In testimony whereof, I have signed my name to this specification.

CARL A. KELLOGG.