April 30, 1935. E. G. NIXON 1,999,472

WEB FED PRINTING MACHINE

Filed May 17, 1933 5 Sheets-Sheet 1

Fig. 9.

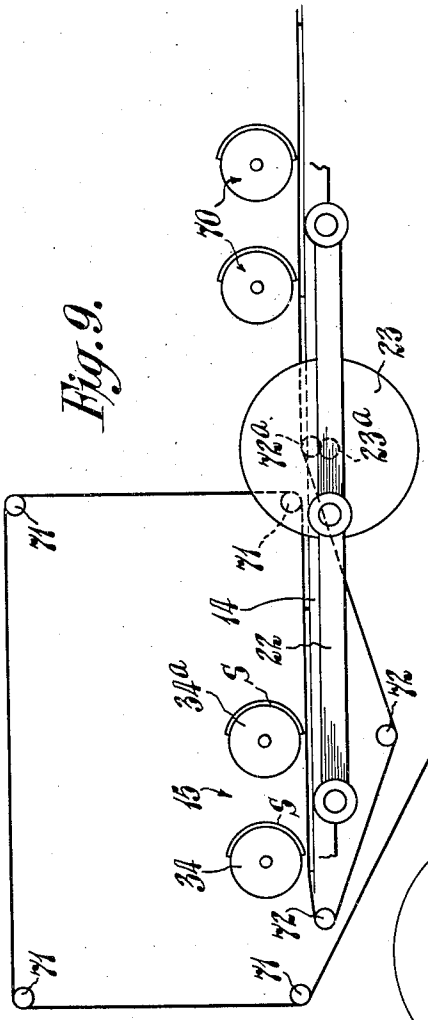
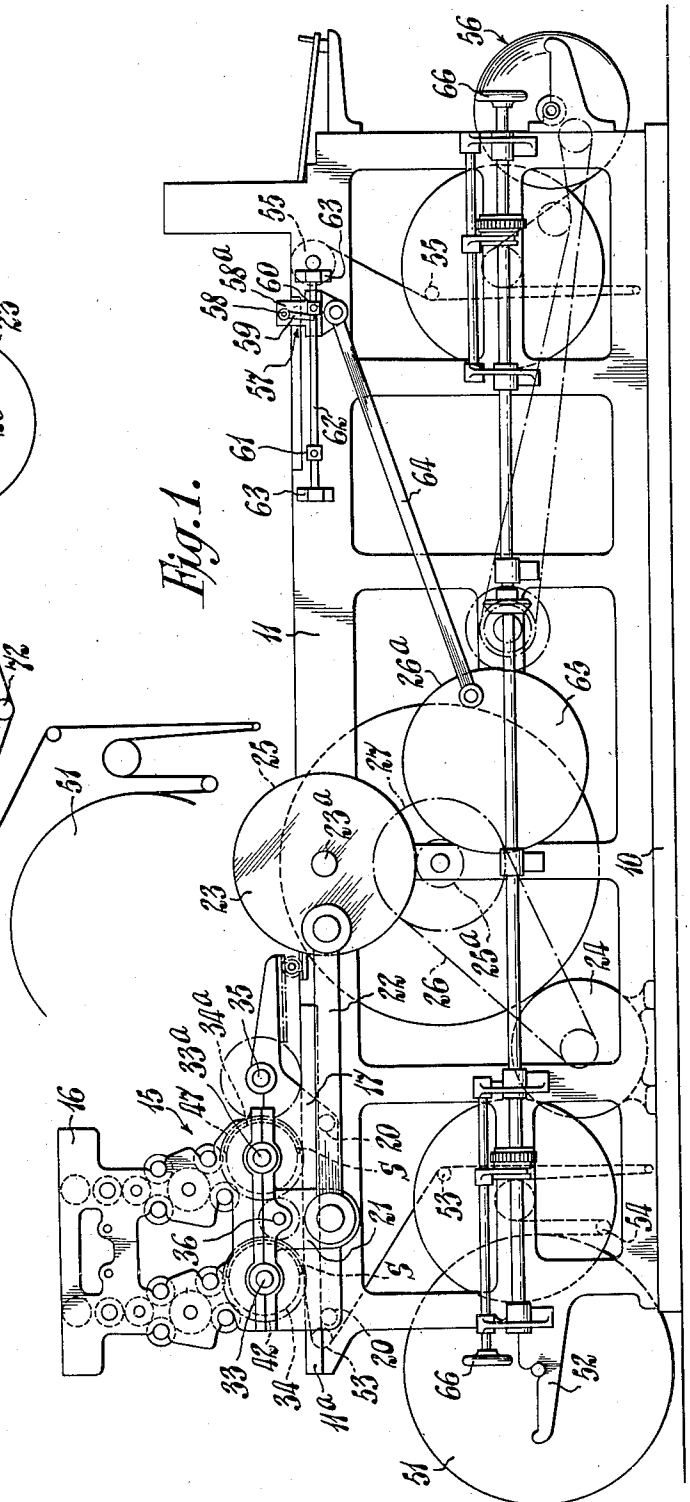


Fig. 1.



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WEB FED PRINTING MACHINE

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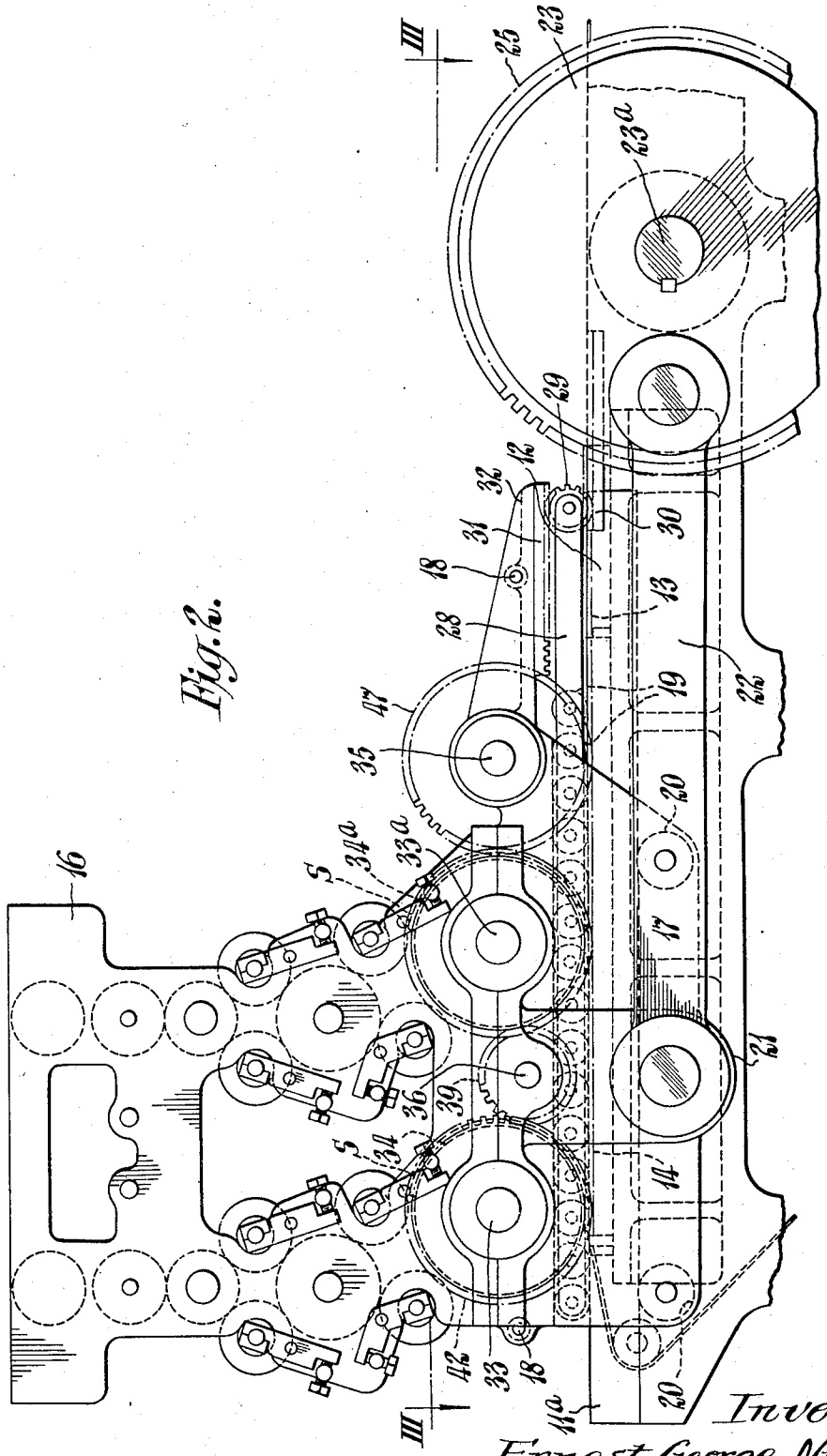


Fig. 2.

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WEB FED PRINTING MACHINE

Filed May 17, 1933 5 Sheets-Sheet 3

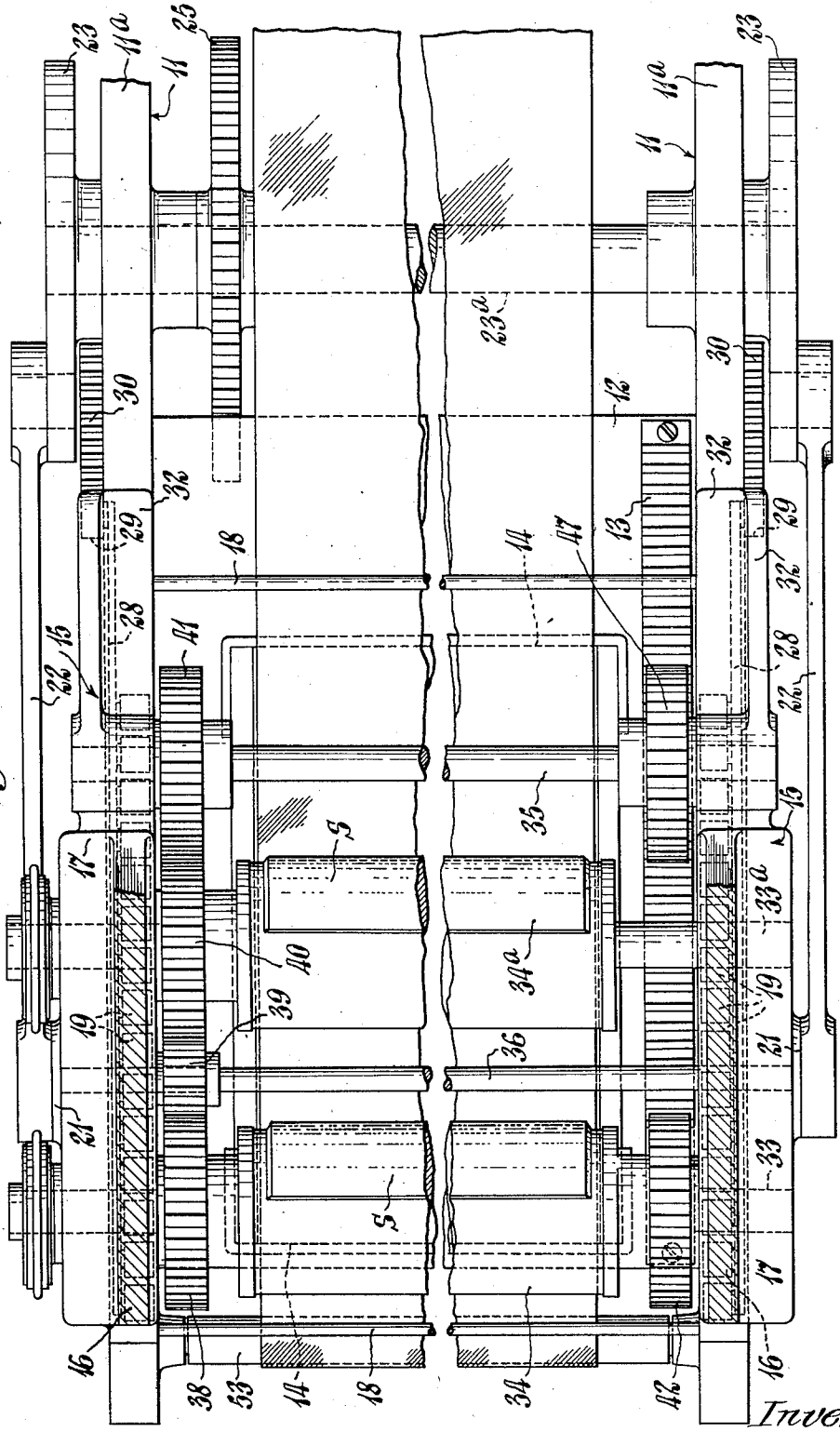


Fig. 3.

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WEB FED PRINTING MACHINE

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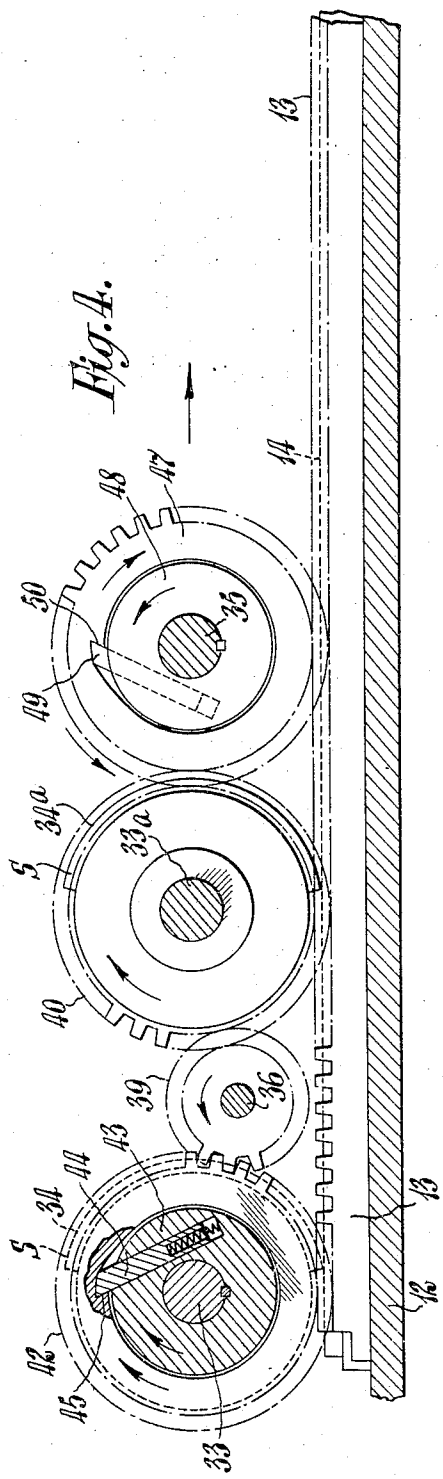


Fig. 4.

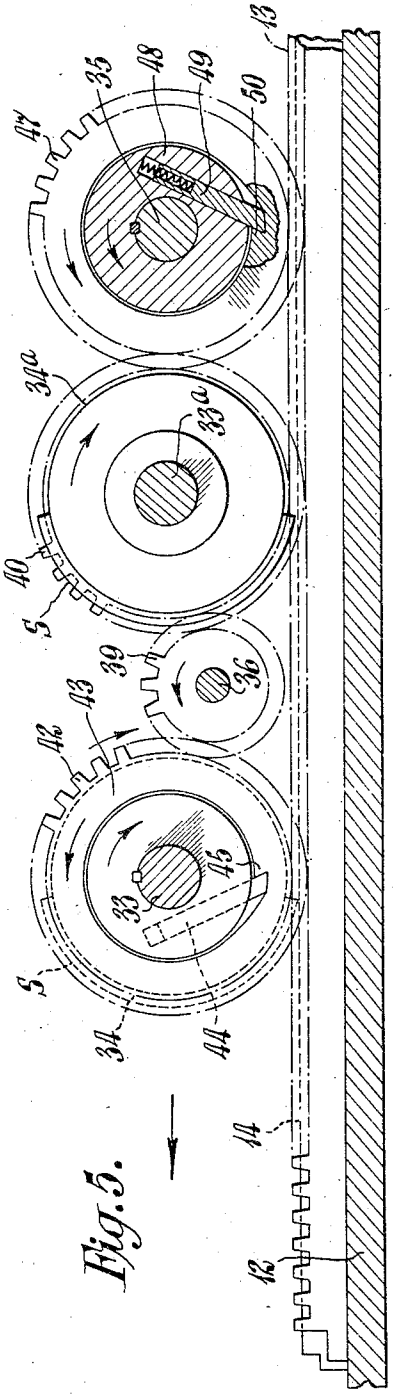


Fig. 5.

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WEB FED PRINTING MACHINE

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Fig. 6.

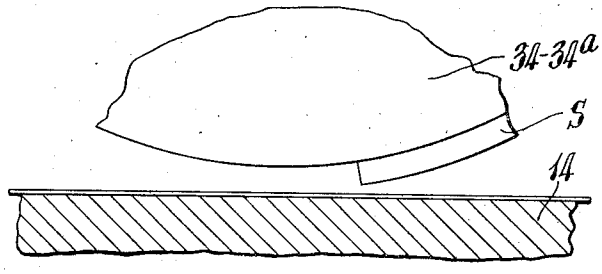


Fig. 7.

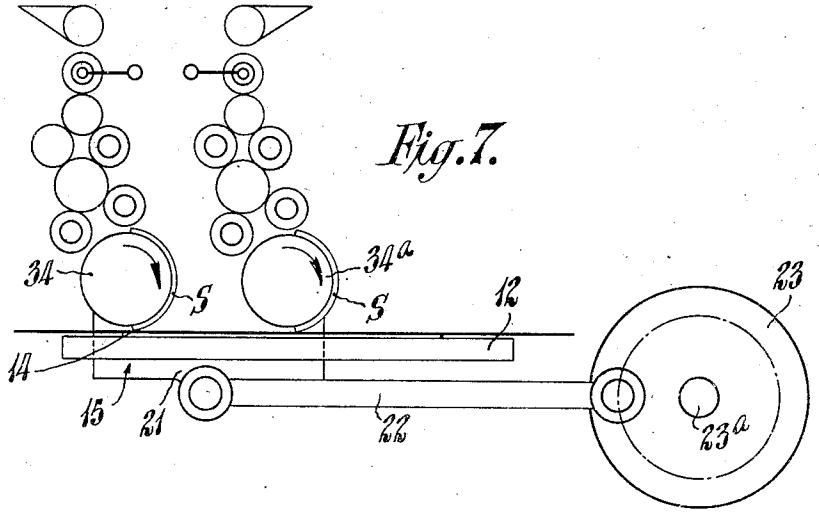
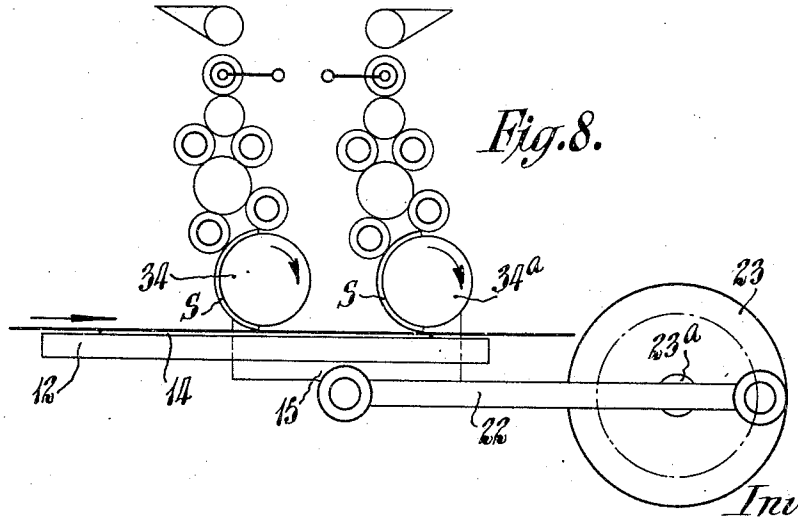


Fig. 8.



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UNITED STATES PATENT OFFICE

1,999,472

WEB-FED PRINTING MACHINE

Ernest George Nixon, London, England

Application May 17, 1933, Serial No. 671,503
In Great Britain October 1, 1932

16 Claims. (Cl. 101—212)

The present invention relates to printing machines and is more particularly concerned with such machines that print on a web and from a reel and which have a variable and intermittent feed of the web.

One object of the present invention is to provide a novel method of operating and arranging a printing couple for use in direct or offset printing which can be used with particular advantage in a web-printing machine. A further object of the invention is to provide printing mechanism in web-printing machines which, in practice, is highly efficient and more simple in operation in the production of single and multi-colour printing and perfecting than apparatus hitherto used for this purpose.

According to the present invention provision is made of a printing machine adapted to print and/or perfect an intermittently fed web of paper or other material by the use of a printing couple comprising a stationary impression bed and a rotary cylinder or cylinders which, or each of which, carries a printing plate extending around one half or less of its circumference and is reciprocated longitudinally of the web to contact at predetermined intervals therewith.

In the preferred form the rotary printing cylinder is adapted to perform a reciprocatory movement in which the axis of the cylinder moves in an imaginary surface which is at all points equidistant from the surface of the bed while the cylinder in performing said movement rotates continuously in the same direction.

It is known in offset machines to provide a stationary flat form bed and a rotary, travelling offset cylinder, but these machines operate on sheets. Also a web-printing and perfecting machine has been proposed in which provision is made of a rotary printing cylinder or cylinders adapted to perform a reciprocatory movement transversely of the direction of travel of the web, the direction of rotation of the printing cylinder or cylinders being reversed in each linear reciprocation thereof.

In order that the invention may be more clearly understood, a constructional embodiment of the invention together with a modification thereof will now be described with reference to the accompanying drawings in which:

Fig. 1 is a side elevational view of a web printing machine constructed with a stationary impression bed and travelling printing cylinder arranged to carry into effect the method of the present invention.

Fig. 2 is an elevational view, drawn to a larger scale of the travelling printing cylinder and the associated actuating mechanism.

Fig. 3 is a part sectional, broken top plan view of Fig. 2.

Figs. 4 and 5 are detail views, in elevation, of the ratchet members forming part of the rack and pinion drive of the travelling printing cylinders.

Fig. 6 is a fragmentary view of the printing cylinder and platen showing the relative clearance provided by the cut away printing cylinder at the extreme point of the printing stroke.

Figs. 7 and 8 are diagrammatic views showing the relative positions of the printing couple during a complete reciprocatory movement, and

Fig. 9 is a diagrammatic view showing an arrangement of the web run for the purpose of perfecting the printed web.

Referring more particularly to Figs. 1, 2 and 3 the printing machine comprises a sole or base plate 10 to which are secured upwardly extending side frames 11 secured to which is the preferably horizontal platen bed or impression bed 12. The impression bed 12 is therefore stationary and carries on its upper surface along one lateral edge thereof a fixed toothed rack 13. As shown in Fig. 3 the rack lies close to and parallel with the inner lateral edge of one of the side frames 11 the upper surfaces of which are outwardly overhung and machined or otherwise shaped to form roller runways 11*a* which are adapted to receive and support the rollers of a longitudinally reciprocatory printing carriage as hereinafter described. The impression bed 12 (as shown in Figs. 3, 4 and 5) forms the support for a platen 14 over which travels the printing carriage 15. The carriage 15 comprises longitudinal side members 16 having downwardly extending lateral flanges or skirts 17 and secured by transverse tie rods 18. The carriage side members 16 each are provided with a series of inwardly projecting rollers or runners 19 which ride upon the runways 11*a* so as slidably to support the carriage 15. The rollers or runners 19 are journalled in freely movable slide bars or bearing strips 28 which extend longitudinally of the frames 11 and are guided in suitable slots provided in the inner faces of the skirts 17. At one extremity these strips 28 carry rotatably mounted pinion wheels 29 which engage a lower toothed rack 30 rigidly mounted upon the side frames 11 and upper toothed racks 31 carried by extensions or nose pieces 32 of the carriage members 16 (Fig. 2). By this arrangement a differential movement of the bearing strips 28 and runners 19 relatively to the

movement of the carriage 15 is obtained which obviates a considerable amount of the friction normally set up in a movement between surfaces of this nature. The skirts 17 overhanging the outer sides of the frames 11 carry rotatably journalled rollers or runners 20 which engage the under surface of the outwardly overhung runways 11a to retain the carriage upon the runways. Downwardly extending lugs 21 are provided on the outer faces of the skirts 17 to form bearing brackets for the journals of connecting rods 22 which at their other extremities are pinned to crank discs 23 (Figs. 2 and 3) the throw of which may be set as shown or if desired made adjustable in known manner. The crank discs 23 are mounted upon the outwardly projecting ends of a transverse shaft 23a and are driven from the electric motor 24 through a gear train comprising gears 25, 25a and chain and sprocket drive 26 and 27 (Fig. 1).

The carriage side members 16 are adapted to provide bearing brackets journalled in which are the transverse shafts 33 and 33a respectively carrying the printing cylinders 34 and 34a and requisite driving gears therefor, a shaft 35 carrying the reverse drive gears, and a shaft 36 carrying an idler gear for a purpose hereinafter described. Referring more particularly to Figs. 3, 4 and 5, the arrangement of the driving mechanism for the printing cylinders 34, 34a is as follows:

The shaft 33 of printing cylinder 34 has keyed to one of its extremities (see Fig. 3) a spur gear wheel 38 which meshes with an idler gear 39 which in turn meshes with a spur gear 40 keyed to the shaft 33a of the printing cylinder 34a and meshing with a spur gear 41 of similar pitch which is keyed to the shaft 35. At its opposite extremity the shaft 33 carries a toothed ring 42 which embraces a hub 43 keyed to the shaft 33 and carrying a spring loaded pawl 44 adapted to engage a ratchet step or tooth 45, formed in the inner rim of the toothed ring 42, when the ring 42 is revolved in a clockwise direction in travelling from left to right in mesh with the teeth of the rack 13 (Fig. 4). The shaft 35 on this side carries a similar toothed ring 47 likewise in mesh with the teeth of the rack 13 and embracing a hub 48 keyed to the shaft 35. This hub 48 accommodates a spring loaded pawl 49, which is adapted to engage a ratchet step or tooth 50, formed in the inner rim of the toothed ring 47, when the ring 47 is rotated in an anti-clockwise direction. As above mentioned the gears 38 and 40 carried by the shafts 33 and 33a respectively are in constant mesh with the interposed idler gear 39 so that the printing cylinders 34 and 34a are rotated always in the same direction by the positive drive of either of the spur gears 42 and 47.

It will be seen that in the displacement of the printing carriage 15 which for each printing operation is from left to right as viewed in Figs. 4 and 5, the toothed ring 42 in traversing the rack 13 is rotated in clockwise direction and thus clutches and rotates the shaft 33 together with the printing cylinder 34 and spur gear 38 in the clockwise direction. The idler gear 39 mounted on the shaft 36 and in mesh with spur gear 38 rotates in anti-clockwise direction and therefore rotates gear 40 in clockwise direction. Since the gear 40 is keyed to shaft 33a the latter together with the printing cylinder 34a is also rotated in clockwise direction while the toothed ring 47 rotates idly in clockwise direction.

In the return stroke of the printing carriage, i. e. from right to left in the drawings (Fig. 5), the toothed ring 47 rotates in anti-clockwise direction and thus clutches the hub 48 so to rotate the shaft 35 and gear 41 in anti-clockwise direction. The gear 41 meshing directly with gear 40 carried by the shaft 33a rotates the latter and the printing cylinder 34a in clockwise direction as before so that a continuous rotation of the printing cylinders 34 and 34a in clockwise direction is maintained despite the reversal of the movement of the printing carriage 15 in the reciprocation thereof.

As shown in Figs. 1 and 2, the printing carriage 15 serves to support inking devices of well known type and which in the present construction can be positioned, if desired in an adjustable manner, so as to be in constant contact with the printing surfaces of the cylinders 34 and 34a and since the printing cylinders are rotated continuously in one direction highly efficient ink distribution is attained.

The web to be printed is contained in the usual mill-supply roll 51 supported transversely of the machine frame on brackets 52 in usual manner. As seen in Fig. 1 this supply roll 51 is positioned below the left hand extremity of the impression bed 12 and led over and around the known guiding and tensioning devices 53 and 54 so as to pass over the platen and longitudinally of the impression bed to similar guides 55 at the further extremity of the machine where, if desired, the web is fed to a re-winding apparatus 56 or alternatively passed through a guillotine device (not shown) whereby the printed web is severed in sheets or multi-printed sections which may be delivered in known manner to sheet folding, delivery or stacking means. Known means for mechanically advancing the web in intermittent steps of movement which correspond to the effective length of stroke of the printing mechanism are shown in Fig. 1 and comprise a slide bar 57, or number of such bars positioned immediately beneath the web at the end of its horizontal run and co-operating with plunger members (not shown) having friction surfaces normally suspended above the web and aligned with the slide bars 57 so that the web is clamped between the slide bars and associated plunger members when the latter are downwardly tripped. Means for controlling the movement of the plungers are provided by mounting them on a transverse shaft 58, which is journalled in slide members positioned to each side of the machine and one of which is shown at 58a. The slide members are mounted upon guide bars 62 supported parallel to the side frames 11 by brackets 63 secured to the frames and the slides are reciprocated by means of connecting rods secured at one extremity thereto and linked in an adjustable manner to crank disc 65 mounted upon the shaft carrying the gear 26a so that the reciprocation of the web feed device is achieved in strictly timed relation to the movement of the printing carriage 15. The web engaging and release movement of the plungers is attained in known manner by a semi-rotary movement of the shaft 58 and this movement is readily achieved by a trip finger 59 keyed to the shaft 58 and downwardly extending therefrom to engage in turn the stops 60 and 61. Thus, in the reciprocatory movements of the slide members 58 by reason of the rotation of the crank disc 65, the web engaging plungers are caused to engage the web when the finger 59 is tripped in an anti-clockwise direction by the stop 61, while the release of the web from the clamping action of the

bar **57** and plungers would be effected by contact of the finger **59** with the stop **60** at the limit of the effective stroke of the device. The bar would be returned to the initial inoperative position by spring actuated means (not shown). The variable and intermittent feed can also be effected by other known means such as feed rollers operated by pawl and ratchet wheel.

The regulation and adjustment of the web when rewinding can be manually effected in known manner by the adjusting means indicated in Fig. 1 by the reference **66**.

In perfecting a printed web (i. e. also printing upon the reverse side thereof) by means of the machine above described the machine frame **11** and impression bed **12** would be adapted to receive and support the additional perfecting apparatus to the right of the existing apparatus shown in Fig. 1. As shown diagrammatically in Fig. 9 such perfecting apparatus could comprise a travelling cylinder printing unit **70** constructed and adapted to operate in a precisely similar manner to that described in reference to the unit **15** and operated by a second connecting rod extending from the crank disc **23**.

In the perfecting operation the web would be run from the supply roll **51** and around and over suitable guides **71** and tensioning devices so that the reverse side of the web first passes beneath the printing cylinder of the unit **15** to receive the requisite imprint and then passes round the guides **72** and **72***a* to assume the second printing position beneath the printing cylinders of the unit **70** as previously described. By this arrangement of the web run the first printed surface, when reversed, remains untouched by the guiding and/or tensioning means until reaching the guiding roller **72***a* by which time the ink applied to the web is dry or sufficiently dry to prevent damage to the work.

In the printing mechanism above described the cylinders designated as printing cylinders are utilized for carrying stereo or other printing plate or plates, e. g. as used for photogravure and the maximum printing surface thus provided comprises rather less than one half of the circumference of the cylinders. In this arrangement the continuous rotation of the printing cylinder carries the printing surface S thereof clear of the work immediately the effective printing stroke of the cylinder is completed, as shown in Fig. 7, and until the printing carriage has completed its reciprocatory movement to the initial position at the commencement of the next printing stroke (as shown in Fig. 8). The clearance thus provided between the web and the printing surface of the printing cylinder is clearly shown in the enlarged fragmentary view, Fig. 6, and enables the intermittent movement of the web to each fresh printing position to take place freely and without contact with the printing surface of the printing cylinder.

In the operation of the printing machine above described the web run from the supply reel **51** passes over the platen in intermittent steps of movement from left to right as viewed in Fig. 1. The steps of movement of the web are carefully co-ordinated in relation to the effective stroke of the printing carriage **15** so that in two colour printing such as may readily be carried into effect on this machine the web is advanced sufficiently to register with the printing surface of the cylinder **34***a* the impression received in the previous operative movement of the printing cylinder **34**. Despite variation in the extent of printing area and/or the size of the sheets to result from the web such co-ordination is readily maintained by the adjustability of the crank discs **25** and **65**.

After the printing and, if desired, perfecting of the web, the latter may advance in intermittent steps past auxiliary devices, e. g., numbering, perforating and punching devices, and thereafter as above stated to a suitable re-winding device or alternatively to a cutting and trimming device and if desired to folding devices in known manner.

It will be appreciated that in the method of operation one or a plurality of cylinders can be used for the purpose of multi-colour printing and moreover by a re-arrangement of the web run the perfecting arrangement described in reference to Fig. 9 could if desired be used as part of a single side multi-colour printing arrangement.

The printing can be effected by the use of stereo or other metal plates, by composition plates or by the use of rubber plates for letter press printing or the like, or the cylinder can be arranged for ordinary offset printing or dry offset printing as may be desired.

I claim:

1. A printing machine adapted to print and/or perfect an intermittently fed web, including a printing couple comprising a stationary impression bed to support the web during printing, at least one rotary cylinder adapted to carry a printing plate extending around not more than one half of its circumference, means for reciprocating said cylinder longitudinally of the web, and associated means for rotating said cylinder in one direction only so that the printing plate contacts at predetermined intervals with said web.

2. A printing machine adapted to print and/or perfect an intermittently fed web, including a printing couple comprising a stationary impression bed to support the web during printing, a rotary printing cylinder adapted to carry a printing plate extending around not more than one-half of its circumference and to move with its axis in an imaginary surface at all points equidistant from the surface of said bed, and means for rotating said cylinder in one direction only while it moves to perform each printing operation and return to its initial position.

3. A printing machine adapted to print and/or perfect an intermittently fed web, including a printing couple comprising a stationary impression bed to support the web during printing, a plurality of rotary printing cylinders each adapted to carry a printing plate extending around not more than one-half of its circumference and to move with their axes in an imaginary surface at all points equidistant from the surface of said bed, and means for rotating said cylinders in one direction only while they move to perform each printing operation and return to their initial position.

4. A printing machine adapted to print and/or perfect an intermittently fed web, comprising a stationary impression bed to support the web during printing, a rotary cylinder arranged to carry a printing plate extending around not more than one half the circumference of said cylinder, and adapted to move with its axis in an imaginary surface at all points equidistant from the surface of said bed, and means for rotating said cylinder in one direction only while it moves to perform each printing operation and return to its initial position.

5. A printing machine adapted to print and/or perfect an intermittently fed web, including a printing couple comprising a stationary impression bed to support the web during printing, a travelling carriage adapted to move across said bed, at least one printing roller rotatably mounted on said carriage, inking devices mounted on said carriage and operatively associated with said printing roller, means for reciprocating said carriage to cause said cylinder to contact at predetermined intervals with the web, means for preventing a printing operation on the return stroke, and means for rotating said cylinder in one direction only during its reciprocatory movement.

6. A printing machine adapted to print and/or perfect an intermittently fed web, including a printing couple comprising a stationary impression bed to support the web during printing, at least one rotary cylinder adapted to carry a printing plate extending around not more than one half of its circumference, means for reciprocating said printing cylinder to cause said cylinder to contact at predetermined intervals with the web, and associated means for rotating said printing cylinder in one direction only during its reciprocation.

7. A printing machine adapted to print and/or perfect an intermittently fed web, including a printing couple comprising a stationary impression bed to support the web during printing, a plurality of printing cylinders each adapted to carry a printing plate extending round not more than one half of its circumference, means for reciprocating said cylinders longitudinally of the web to cause said cylinders to contact at predetermined intervals with said web, and associated means for rotating said printing cylinders in one direction only during the reciprocatory movement.

8. A printing machine as claimed in claim 5 including means for progressing the web in intermittent steps of movement across the impression bed, means for adjusting the extent of said movement, means for imparting a reciprocatory movement to said carriage, and means for timing the movement of said printing carriage in accordance with the feed of the web.

9. A printing machine adapted to print and/or perfect an intermittently fed web, including a stationary impression bed, means for guiding the web over said bed, at least one toothed rack associated with said bed, a slidably mounted printing carriage, means for periodically reciprocating said carriage longitudinally of said bed at least one printing cylinder rotatably mounted upon said carriage and arranged to contact periodically with said web, means for preventing a printing operation on the return stroke, a train of constantly meshed gears adapted to drive said printing cylinder in one direction only, a toothed driving pinion adapted to move with said printing carriage and mesh with said toothed rack to drive said gears when rotated in clockwise direction, and a second toothed driving pinion adapted to move with said printing carriage and mesh with said toothed rack to drive said gears when rotating in anticlockwise direction.

10. A printing machine as claimed in claim 9 wherein provision is made of runners to support said printing carriage, runways to support said runners, and means for effecting differential displacement of said runners relatively to the displacement of the carriage as set forth.

11. A printing machine adapted to print and/or perfect an intermittently fed web, including a stationary impression bed, a plurality of printing rollers, means for reciprocating said printing rollers relatively to said impression bed, means for preventing a printing operation on the return stroke, means for rotating said printing rollers in one direction only during their reciprocatory movements, web-guiding means adapted to position the web upon said bed so that one surface of the web is caused to contact with at least one of said printing rollers to print said web, further web-guiding means adapted subsequently to guide the web so that the reverse side thereof is presented for contact with at least one of said printing rollers to effect the perfecting of the web.

12. A printing machine adapted to print and/or perfect an intermittently fed web, comprising a pair of side frames, a substantially horizontal impression bed supported between said frames, parallel runways extending longitudinally of said frame and impression bed, a movable carriage supported by runners adapted to travel upon said runways, at least one printing cylinder rotatably supported on said carriage, means for preventing a printing operation on the return stroke, a train of gears adapted to rotate said cylinder in one direction only, means actuated by the movement of said carriage for driving said gears, means for guiding the web between said impression bed and said printing cylinder, means for progressing the web step by step and in timed relation to the reciprocation of said carriage and printing cylinder, and inking devices mounted upon said carriage and operatively associated with said printing cylinder.

13. A printing machine adapted to print and/or perfect an intermittently fed web, comprising a pair of side frames, a substantially horizontal impression bed held between said frames and adapted to support a platen, parallel runways extending longitudinally of said bed, a movable carriage supported by runners adapted to travel upon said runways, a toothed rack member extending longitudinally of said bed, at least one printing cylinder rotatably mounted on said carriage, a printing plate extending around not more than one half of said cylinder, a train of gears adapted to drive the printing cylinder in one direction only, a driving pinion adapted to move with said carriage and mesh with said toothed rack to drive said gears when rotated in clockwise direction, a second driving pinion adapted to move with said carriage and mesh with said toothed rack to drive said gears when rotated in anticlockwise direction, means for reciprocating said carriage and printing roller longitudinally of the printing plate and above said platen, means for guiding the paper web between said platen and said printing cylinder, and means for advancing said web step by step in timed relation to the reciprocation of said printing cylinder.

14. A printing machine as claimed in claim 9, wherein each driving pinion comprises an axial member, a hub keyed to said axial member, a toothed ring adapted to embrace said hub and mesh with the toothed rack, said ring having a detent formed in one face thereof, and a spring loaded pawl housed in said hub and adapted to engage the detent in said ring during the rotation of the latter in one direction, said pawls serving to clutch said toothed rings to the associated hubs to rotate the latter in opposed directions of rotation.

15. A printing machine adapted to print and perfect an intermittently fed web, including a flat substantially horizontal impression bed, a print-

ing unit comprising at least one rotary printing cylinder adapted to move over the surface of said impression bed, means for rotating said cylinder in one direction only during its displacing movement, a second printing unit comprising at least one rotary printing cylinder adapted to move over the surface of said impression bed, means for rotating said cylinder continuously in one direction during its displacing movement, web-guiding means adapted to position the web upon said impression bed so that one surface thereof is exposed to contact with said first printing cylinder, further web-guiding means adapted subsequently to position said web upon said impression bed with the reverse side thereof exposed to contact with said second printing cylinder, means for reciprocating said printing units longitudinally of said web so that the latter is printed and perfected during a step by step movement across said impression bed.

16. A printing machine adapted to print and/or perfect an intermittently fed web, including a printing couple comprising a stationary impression bed to support the web during printing, at least one rotary cylinder adapted to carry a printing plate extending around not more than one-half of its circumference, and means for reciprocating said cylinder longitudinally of the web and for intermittently rotating said cylinder in one direction to cause the printing plate to contact at predetermined intervals with said web only during the longitudinal movement in one direction.

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