No. 648,984. Patented May 8, 1900.

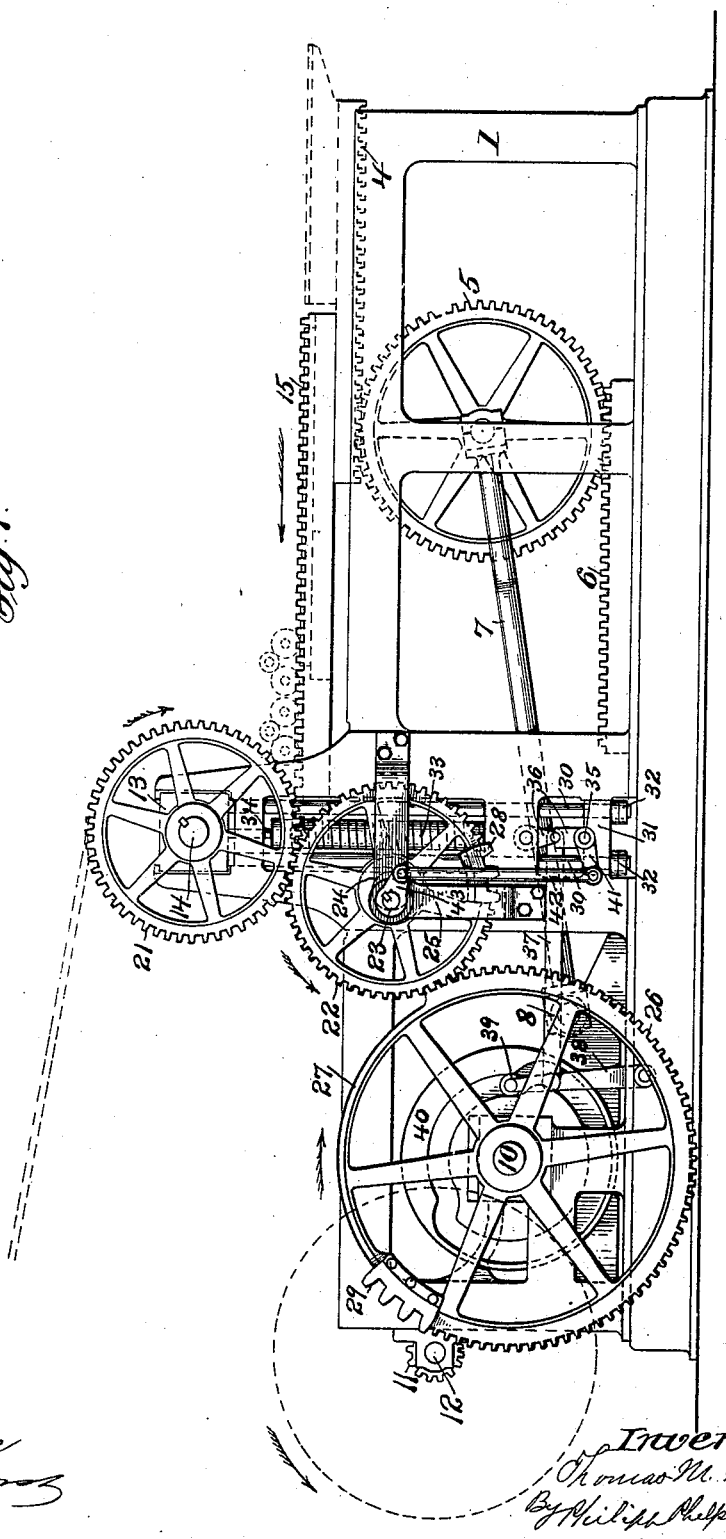
T. M. NORTH.

BED AND CYLINDER PRINTING MACHINE.

(Application filed June 19, 1899.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

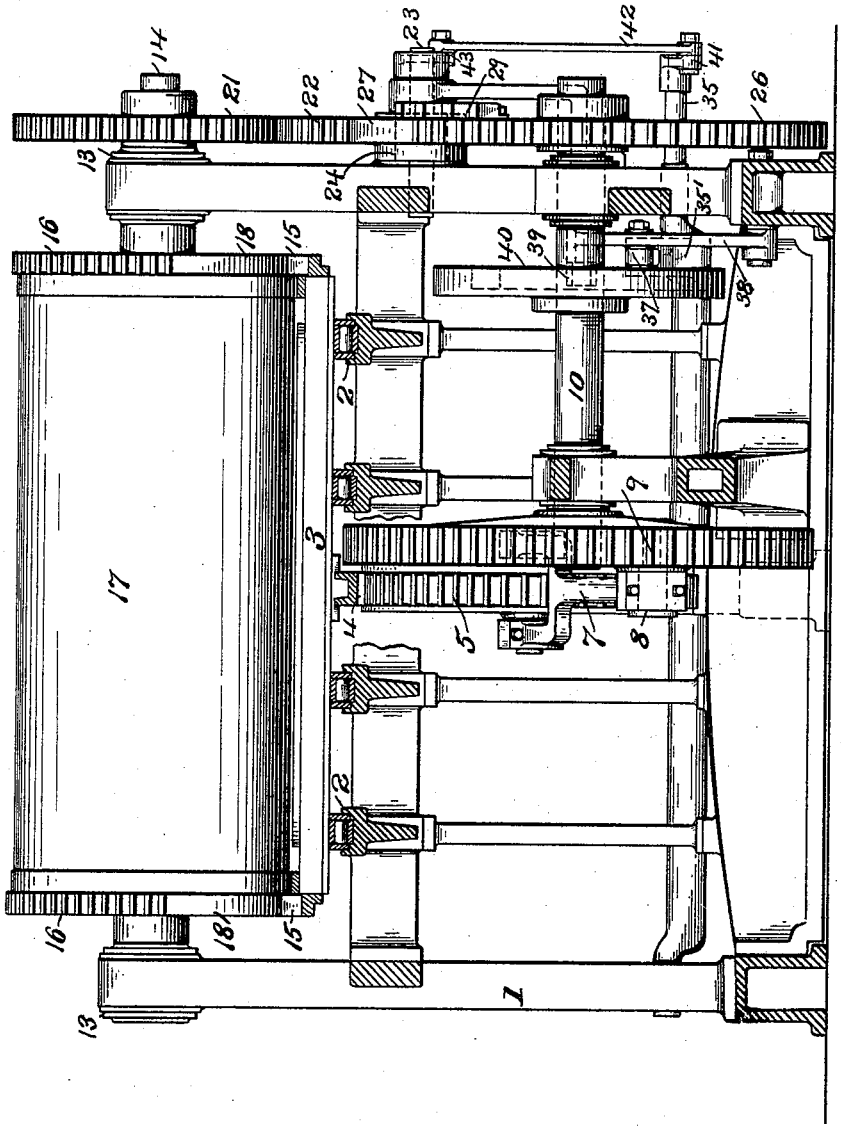

Fig. 2.

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(No Model.) 4 Sheets—Sheet 3.

Fig. 3.

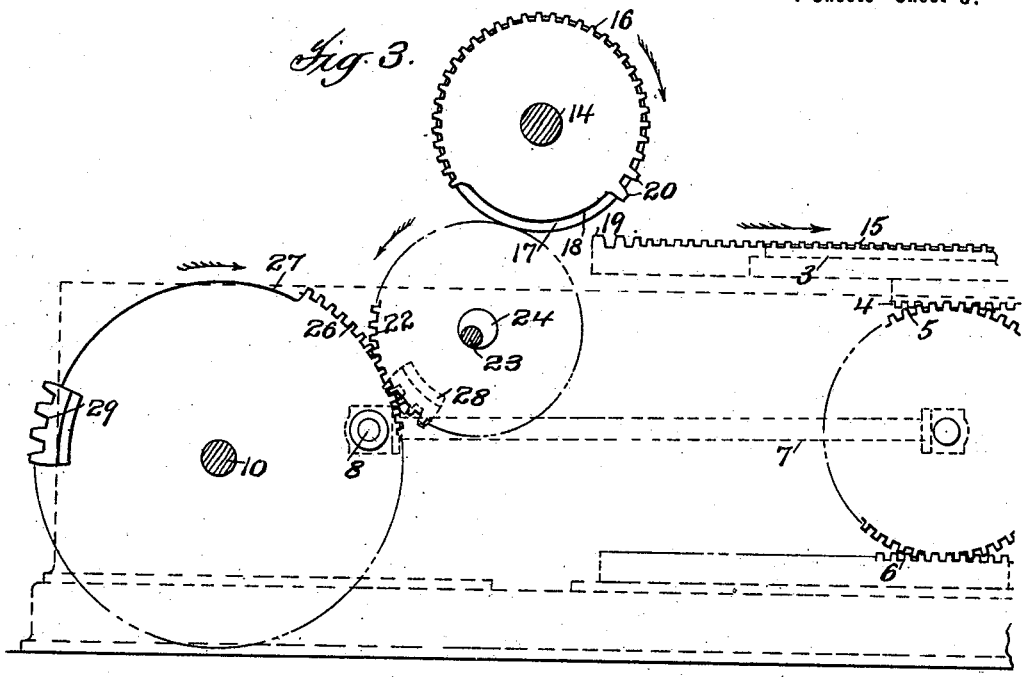
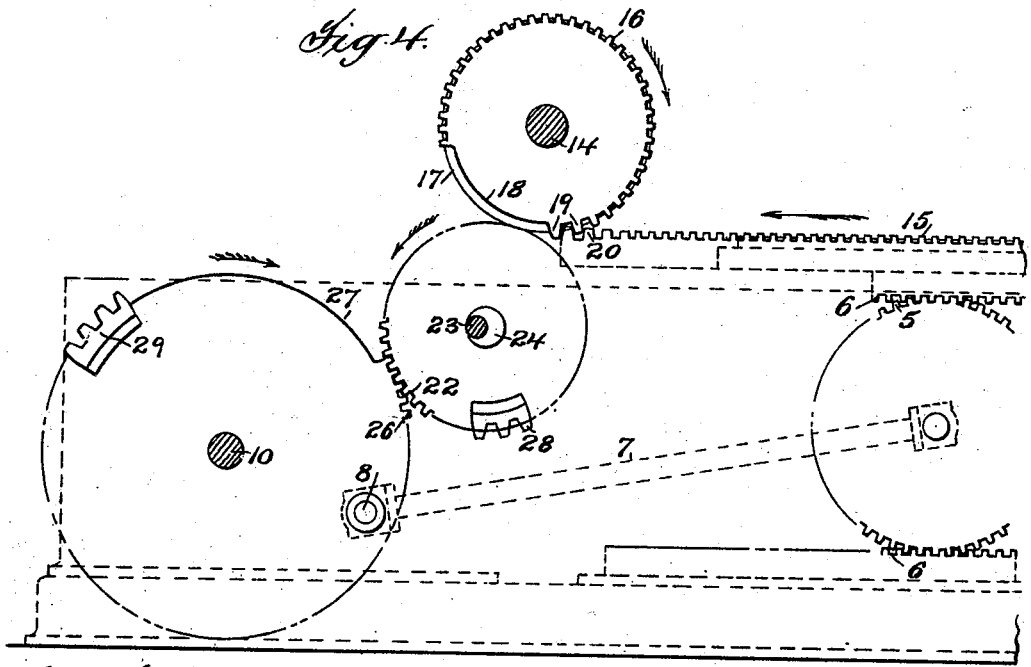


Fig. 4.



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(No Model.) 4 Sheets—Sheet 4.

Fig. 5.

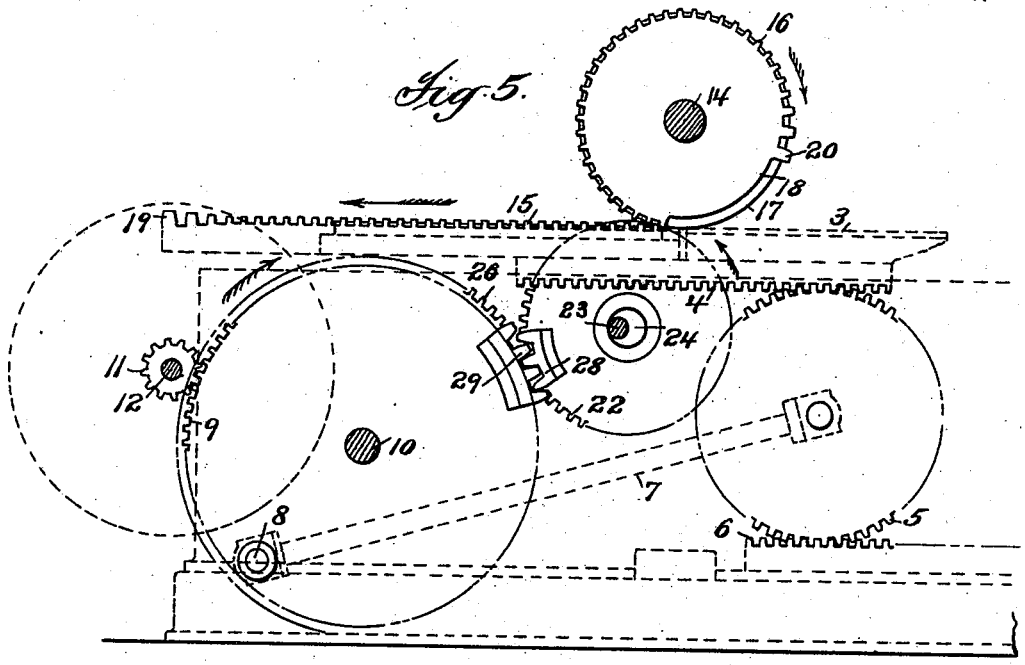
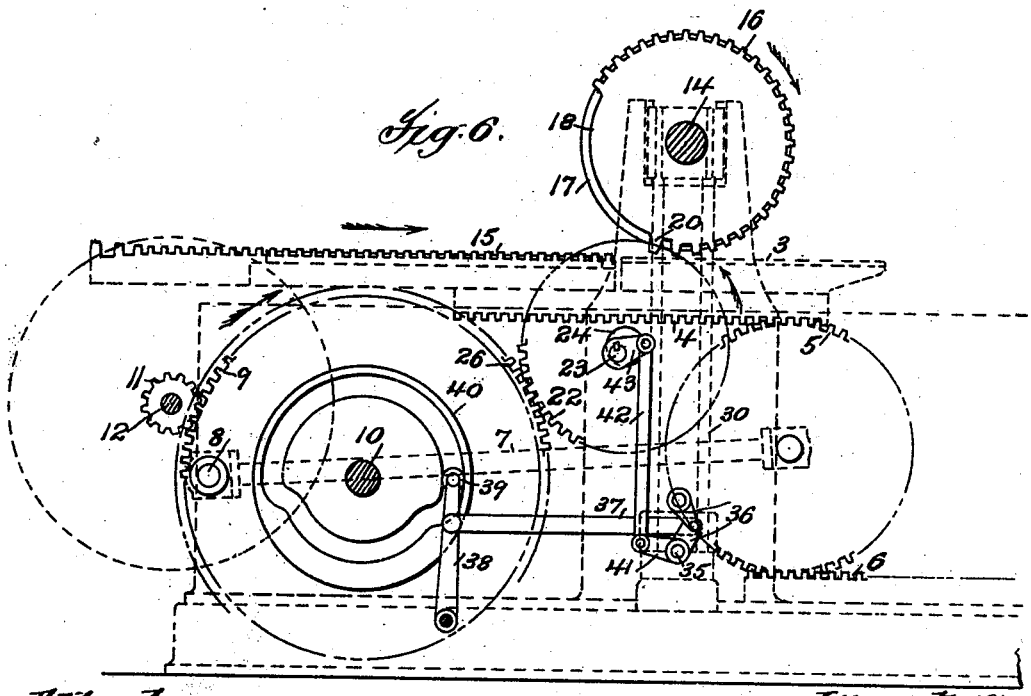


Fig. 6.



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UNITED STATES PATENT OFFICE.

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BED-AND-CYLINDER PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 648,984, dated May 8, 1900.

Application filed June 19, 1899. Serial No. 721,047. (No model.)

To all whom it may concern:

Be it known that I, THOMAS M. NORTH, a subject of the Queen of Great Britain and Ireland, residing at New York city, county of Kings, and State of New York, have invented certain new and useful Improvements in Bed-and-Cylinder Printing-Machines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to certain improvements in printing-machines, and more particularly to that class of machines employing a bed driven at a varying speed and a continuously-moving cylinder, the cylinder being driven in synchronism with the bed during part of the printing stroke and by an independent mechanism running at a constant speed while the bed completes its printing stroke, reverses, and begins a second printing stroke.

In bed-and-cylinder machines of the class referred to it is desirable to drive the bed at a high speed, so that the output of the machine may be as large as possible during the greater part of both strokes and at the same time to slow it down when near the end of each stroke, so that it may be stopped and reversed as easily as possible and without shock or jar. A simple and efficient construction for driving the bed at high speeds and effecting its reversal without undue shock or jar is secured by the use of a crank movement or a movement which corresponds to that produced by a crank. By the use of such constructions the speed of the bed is rapidly increased from the point of reverse up to a point near the middle of its stroke. From this point to the middle of the stroke, at which the maximum speed is reached, and for a similar distance on the other side of the middle of the stroke the movement of the bed produced is nearly, though not exactly, constant, after which it rapidly decreases to the point of reverse at the end of the stroke. Beginning at the point of reverse, therefore, the bed runs at a rapidly-increasing speed up to a point near the middle of its stroke, then at a more nearly constant speed, and then at a rapidly-decreasing speed from a similar point on the other side of the middle to the point of reverse, the result being that the bed may be run at high speeds and brought to a gradual stop without excessive shock or jar. As is well known, in order to produce good printing results it is important that the speed of the impression-cylinder exactly coincide with the bed during the printing operation. If, however, the heavy impression-cylinder be driven throughout its movement at varying speeds corresponding to the varying speeds of the bed during the entire printing stroke, there is a great loss of power and a strain upon the parts resulting from the constant changes in the speed of both the bed and the cylinder. The practical result of driving the bed and cylinder in unison and at constantly-varying speeds throughout the stroke of the bed has therefore been to very considerably reduce the speed of the members, and in presses so driven there has been a great waste of power. It is desirable, therefore, to so arrange the machine that the printing operation occurs during the middle of the stroke of the bed, at which time the speed, as has been said, is more nearly constant, and to drive the cylinder in unison with the bed during this part of the stroke, driving the cylinder thereafter by an independent mechanism which runs at a constant speed, thereby relieving the variable-speed driving mechanism of the strain which would result from the necessity of speeding up and slowing down the heavy cylinder. In the Patents Nos. 622,125, 622,126, and 622,127, issued March 28, 1899, to Robert Hoe, Theodore H. Mead, and Charles W. Carpenter as assignees of L. C. Crowell, constructions are disclosed in which in bed-and-cylinder printing-machines of the type referred to the bed is driven at a variable speed and the cylinder is driven in synchronism with the bed and preferably by the bed during the middle part of the stroke of the bed or at a time when its speed is more nearly constant, and during the remainder of the time the cylinder is driven by a constant-speed mechanism which operates to drive the cylinder at a constant speed during substantially the non-printing part of the printing stroke of the bed and during the entire return stroke of the bed. In these constructions the advantages secured by driving the bed by variable movement,

such as is produced by or corresponding to a crank movement, and the advantage of perfect synchronism between the cylinder and the bed during the printing part of the printing stroke are attained, and at the same time the waste of power which ordinarily results from driving the cylinder at a variable speed throughout the printing stroke of the bed is avoided, since in these constructions the constant-speed mechanism is preferably arranged to run at a speed corresponding to the speed which the bed has just before the printing begins and just after it ends, and the cylinder is transferred from the variable-speed driving mechanism to the constant-speed driving mechanism at the times when the variable speed of the bed corresponds to the speed of the constant-speed mechanism. In these constructions, however, there are preferably used various forms of intermediate devices to connect the cylinder to and disconnect it from the constant and variable speed mechanisms.

It is the object of this invention to secure the results effected in these constructions and at the same time to avoid the use of the auxiliary intermediate connecting devices between the cylinder and the driving mechanisms, thereby simplifying the construction and decreasing the expense of constructing the machine.

With this and other objects in view the invention consists in certain constructions and in certain parts, improvements, and combinations, as will be fully described in the following specification, and the features forming the invention will then be specifically pointed out in the claims hereunto appended.

In the accompanying drawings, which form a part of this specification, and in which like characters of reference indicate the same parts, Figure 1 is a side view of one form of a multirevolution bed-and-cylinder printing-machine embodying the invention. Fig. 2 is a sectional end elevation of the same. Figs. 3, 4, 5, and 6 are diagrammatic views illustrating the position of the bed and cylinder and the several driving connections at various points.

Referring to the drawings, 1 indicates the frame of the machine, which is provided with the usual ways 2, on which the bed 3 reciprocates. The bed may be driven by any suitable form of variable-speed mechanism. In the machine shown the bed is provided with a rack 4, which is engaged by a railroad-gear 5, said gear traveling on a stationary rack 6. The movement of the railroad-gear is produced by a connecting-rod 7, said rod being connected at one end to the axle of the gear and at the other end to a crank-stud 8 on a gear-wheel 9, said wheel being mounted on a short shaft 10, which is suitably located in bearings in the frame. The shaft 10 may be driven in any suitable manner, as through gear 9 and a pinion 11 on a power-shaft 12.

The frame of the machine is provided with suitable standards in which are located the usual sliding boxes 13, said boxes carrying the shaft 14 of the impression-cylinder 17. While the impression-cylinder may be driven by any suitable mechanism which will give it a movement which is synchronous with the bed during the printing part of the printing stroke of the bed, it is preferably driven from the bed. To this end the bed is preferably provided with the ordinary register-racks 15, said racks meshing with gears 16, which may be secured to the cylinder-shaft in any suitable manner, but are preferably secured to the ends of the cylinder 17. While the gears 16 may be complete gears, they are preferably segmental, spaces 18, from which the teeth are cut away, being preferably left, the toothed segments being of sufficient length so as to insure the driving of the cylinder by the racks during the middle portion of the stroke of the bed or during the time when its speed is more nearly constant and also during the time when the printing operation takes place. By this construction the cylinder is driven at a variable speed which is exactly synchronous with the speed of the bed during the printing operation and the advantages of perfect register are secured.

While the teeth on the rack 15 and the teeth on the segment 16 may be of uniform size, certain teeth 19 on the forward end of the rack, or that end which is in advance as the bed is making its printing stroke, are preferably increased in size, and similarly-enlarged teeth 20 are preferably provided on the gear 16. The purpose of thus enlarging these teeth will be hereinafter stated.

Inasmuch as the cylinder is not to be driven by the bed during the entire stroke and is to be driven at a constant speed after it ceases to be driven by the racks, suitable constant-speed mechanism must be provided. While this mechanism may be varied within wide limits, the cylinder-shaft 14 is preferably provided with a gear 21, this gear being secured to the shaft by a key or in any other suitable manner. This gear constitutes a driving mechanism for the cylinder, and it will be noted that this gear is always connected to the cylinder. The gear 21 may be continuously driven in any suitable manner. Preferably, however, this gear is constantly in mesh with an intermediate 22, said intermediate being mounted on a shaft 23, which finds its bearing at one end in a bracket 25, secured to the frame of the machine, and at its other end in the machine-frame. While this gear may be a stationary gear, if desired, it is preferably mounted on an eccentric 24, which is carried on the shaft 23. The purpose of thus mounting the gear on an eccentric will be hereinafter explained.

In the machine shown the intermediate 22 is driven by a large gear 26, mounted on the shaft 10, which is driven at a constant speed, said gear preferably having cut-away portions 27. The intermediate 22 and the gear 26 are

preferably provided with short curved racks 28 and 29, the teeth of which are enlarged for a purpose to be described. It may here be stated, however, that these curved racks, while deemed preferable, are not essential to the operation of the machine and may be omitted, if desired.

Inasmuch as the cylinder is not in contact with the bed except during the printing operation, means must be employed to separate the cylinder and the bed during the period in which they are out of contact, and this separation is preferably, though not necessarily, accomplished by raising the cylinder. The cylinder-raising means may be of various kinds. In the machine shown, however, the cylinder-boxes 13 have connected to them rods 30, which pass through sliding cross-pieces 31, which are guided in ways in the frame of the machine, said rods having nuts 32 on their lower ends. Suitable springs 33 are located in the frame, and these springs operate through short push-rods 34 against the lower sides of the cylinder-boxes. In the cross-pieces 31 is journaled a rock-shaft 35. On each side of the machine is located a pair of toggles 36, the lower members of these toggles being carried by this rock-shaft, the other members being suitably mounted in the frame. The shaft 35 is provided with a rock-arm 35′, which is connected by a rod 37 to a lever 38, said lever 38 carrying a bowl 39, which engages a grooved cam 40, mounted on the shaft 10.

The construction just described forms a well-known form of cylinder raising and lowering mechanism and, specifically considered, forms no part of the invention, as any other suitable form of raising and lowering mechanism may be substituted therefor.

The shaft 35 is provided with an arm 41, said arm being connected by a rod 42 to an arm 43 on the shaft 23, which carries the eccentric 24, before described.

The construction being as before described, the operation is as follows, reference being had to the diagrams shown in Figs. 3 to 6, inclusive: In the position of the parts shown in Fig. 3 the crank is nearly on its center, and consequently the bed has nearly completed its return stroke. At this time the intermediate 22, which has been described as constantly in mesh with the gear 21 on the cylinder-shaft, is in mesh with the teeth on the segmental gear 26 and the cylinder is raised, so that its segmental gear 16 is out of mesh with the rack 15 on the bed. The cylinder therefore is being driven by the constant-speed gearing 26, 22, and the gear 21, which has been heretofore described as rigidly connected to the cylinder through the medium of the cylinder-shaft. While the cylinder is thus driven, the bed under the influence of the crank driving mechanism finishes its movement to the right to the point of reverse, reverses, and begins its printing stroke. As it moves to the left on its printing stroke its speed constantly increases, and at the time when its speed becomes equal to or very closely approximates the speed which the cylinder has under the influence of the constant-speed gearing, which is preferably just before the printing part of the stroke is reached, the segmental gear 16 reaches such a position that its enlarged teeth 20 run into mesh with the enlarged teeth 19 on the rack 15, the cylinder having in the meantime been lowered by the operation of the raising and lowering devices. As this occurs the teeth on the segmental gear 26 run out of mesh with the teeth on the intermediate 22, so that the cylinder now ceases to be driven by the constant-speed mechanism, but has been picked up by and is under the control of the bed. By providing the enlarged teeth 19 and 20 any slight backlash is provided for and a positive engagement of the rack 15 with the segment 16 is insured. It is of course possible to so time the parts as to cause the rack 15 to engage with the segment 16 without enlarging the teeth; but the enlarged-tooth construction is preferred, as any failure of the teeth to mesh on account of a slight difference in speed between the bed and the cylinder is thus provided against. The position of the parts just described is shown in Fig. 4, in which figure the enlarged teeth 19 and 20 have run into mesh and the teeth on the segment 26 are about to run out of mesh with the teeth on the intermediate 22. As soon as this happens, which is immediately after the bed has assumed control of the cylinder, the intermediate 22, which was driving the cylinder when the constant-speed mechanism had control of the cylinder, is driven by the cylinder-gear 21. The bed continues its printing stroke, and after the printing operation is completed and at the time when the speed of the bed after it has passed the middle of its stroke has decreased until it is again equal to the constant-speed mechanism the gear 16 runs out of mesh with the rack 15, so that the cylinder is no longer driven by the bed. Immediately before this occurs, however, the curved rack 29 on the gear 26 runs into mesh with the curved rack 28 on the intermediate 22, the teeth on these racks being enlarged to provide for an easy and sure engagement for the same reason that the enlarged teeth 19 and 20 are provided. The position of the parts referred to is shown in Fig. 5. The bed being now free from the cylinder continues its stroke, reverses, and returns, the cylinder having in the meantime been raised by the raising and lowering devices and being held out of contact with the bed until the bed completes its stroke to the right, reverses, and again returns to printing position.

While the gear 26 and intermediate 22 can be constructed so that the cylinder may be raised and lowered sufficiently to insure the disengagement between the rack 15 and the gear 16 without causing the gear 26 and intermediate 22 to pass out of mesh, in the

preferred construction the intermediate 22 will be mounted as has been before described—that is, its shaft carries an eccentric, on which the gear runs. When, therefore, the raising and lowering devices operate to raise and lower the cylinder, the movement of the shaft 35, on which the lower members of the toggles are mounted, is transmitted to the eccentric through the arms 41 and 43, the connecting-rod 42, and the shaft 23. As the cylinder moves up, therefore, the intermediate 22 is caused to follow it, the direction of movement being preferably diagonal, so as to in no way disturb the mesh between the teeth on the intermediate 22 and the teeth on the segmental gear 26. When the cylinder is lowered by straightening the toggles, the same connections operate to insure the lowering of the intermediate 22 with the cylinder. A simultaneous movement of the cylinder and the intermediate is therefore provided for.

It will be seen that by the construction described a mechanism is provided in which the bed is driven by a variable-speed mechanism, in which the cylinder is driven in absolute synchronism with the bed during a portion of the printing stroke, in which the cylinder is driven by a constant-speed driving mechanism during that part of the printing stroke when it is not driven in synchronism with the bed, in which the transfer of the cylinder from one driving mechanism to another is effected considerably before the bed reaches the end of its stroke, and consequently while both the bed and the cylinder are running at a high speed, in which the variable-speed mechanism which drives the bed and cylinder is relieved of the necessity of driving the cylinder except during the printing part of the one stroke of the bed, thereby enabling the machine to run at very high speeds, and in which the driving connections are rigidly secured to the cylinder at all times, thus avoiding the use of clutches or similar intermediate devices.

I am aware that it is not new in a bed-and-cylinder printing-machine to provide a cylinder with two segments, one of which meshes with a register-rack on the bed and the other of which operates in connection with what may be termed a "constant-speed" mechanism to drive the cylinder while the bed is making its reverse stroke, the cylinder passing under the control of the constant-speed mechanism when the bed is nearly at the end of its printing stroke, the bed being driven by a crank mechanism. An instance of such a construction is shown in the patent to Potter, No. 131,702, issued September 24, 1872. In this patent, however, the purpose aimed at is totally different from that which is accomplished by my invention. The Potter construction has for its object to utilize as much of the surface of the cylinder as is possible for impression purposes, and at the same time to make the cylinder as small as possible. In this construction, therefore, the segment by which the cylinder is driven from the rack on the bed remains in mesh with that rack until the bed has almost entirely completed its stroke. When the bed in the Potter construction has completed its stroke, the short segmental rack on the cylinder runs into mesh with a constant-driving mechanism which operates to drive the cylinder at very slow speed, thus turning it through only a slight distance of arc. The cylinder, therefore, is driven at a variable speed during nearly the entire printing stroke and the strain due to speeding up and slowing down the cylinder during this stroke is entirely borne by the variable-speed driving mechanism. Inasmuch as Potter's purpose is to make his cylinder as small as possible and to utilize as much of its surface for impression purposes as is possible, the constant-speed mechanism takes the cylinder as near the end of the stroke as possible, for the slower the cylinder can be driven by the constant-speed mechanism the shorter the low side needs to be. In this construction, therefore, there is no gain in the speed of the machine and the strains on the driving mechanism are not relieved.

The purpose of the present invention and the problem solved by it are entirely different, as it aims both to increase the speed of the machine and to relieve the driving mechanism as far as possible from the strains resulting from speeding up and slowing down the cylinder. In constructions embodying the invention, therefore, the constant-speed mechanism must take the cylinder as early as possible after the printing operation is completed and while the cylinder is running at a high or considerable speed in order that the machine may be run at as high a speed as possible and the variable-speed mechanism be relieved from the necessity of driving the cylinder as soon as possible after the printing operation is completed.

It is to be understood that the means by which this invention is carried into effect can be varied widely in many particulars. The invention is not therefore to be limited to the specific construction described in the foregoing specification and illustrated in the accompanying drawings, but is to be regarded as embracing all such modifications and changes as fall within the spirit and scope of the invention.

What I claim is—

1. In a bed-and-cylinder printing-machine, the combination with a bed reciprocating in a right line, of a continuously-rotating cylinder, means for driving the bed at the described variable speed, means for driving the cylinder in synchronism with the bed during a part only of the printing stroke, a gear rigidly connected with the cylinder and having teeth on its periphery, a second gear by which the first gear is intermittently driven, and a constant-speed mechanism operating to drive the second gear and through it the cylinder, the cylinder being transferred from the va-

riable-speed mechanism to the constant-speed mechanism while it is running at a considerable speed and before the bed reaches the end of its stroke, substantially as described.

2. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a continuously-rotating cylinder, means for driving the bed at a variable speed, means for driving the cylinder in synchronism with the bed during a part only of the printing stroke, a gear rigidly connected with the cylinder and having teeth on its periphery, a second gear in constant mesh with the first gear, and a constant-speed mechanism operating to intermittently drive the second gear and through it the cylinder, the cylinder being transferred from the variable-speed mechanism to the constant-speed mechanism while it is running at a considerable speed and before the bed reaches the end of its stroke, substantially as described.

3. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a continuously-rotating multirevolution-cylinder, means for driving the bed at a variable speed, means for driving the cylinder in synchronism with the bed during a part only of the printing stroke, a gear rigidly connected with the cylinder and having teeth on its periphery, a second gear by which the first gear is intermittently driven, a constant-speed mechanism operating to drive the second gear and through it the cylinder, the cylinder being transferred from the variable-speed mechanism to the constant-speed mechanism while it is running at a considerable speed and before the bed reaches the end of its stroke, and means for separating the bed and cylinder during the return stroke of the bed, substantially as described.

4. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a continuously-rotating multirevolution-cylinder, means for driving the bed at a variable speed, means for driving the cylinder in synchronism with the bed during a part only of the printing stroke, a gear rigidly connected with the cylinder and having teeth on its periphery, a second gear by which the first gear is intermittently driven, a constant-speed mechanism operating to drive the second gear and through it the cylinder, the cylinder being transferred from the variable-speed mechanism to the constant-speed mechanism while it is running at a considerable speed and before the bed reaches the end of its stroke, and raising and lowering devices for the cylinder, substantially as described.

5. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a continuously-rotating multirevolution-cylinder, means for driving the bed at a variable speed, means for driving the cylinder in synchronism with the bed during a part only of the printing stroke, a gear rigidly connected with the cylinder and having teeth on its periphery, a second gear in constant mesh with the first gear, a constant-speed mechanism operating to intermittently drive the second gear and through it the cylinder, the cylinder being transferred from the variable-speed mechanism to the constant-speed mechanism while it is running at a considerable speed and before the bed reaches the end of its stroke, and raising and lowering devices for the cylinder, substantially as described.

6. In a bed-and-cylinder printing-machine, the combination with a bed reciprocating in a right line, of a continuously-rotating cylinder, means for driving the bed at the described variable speed, means for driving the cylinder from the bed during a part only of the printing stroke, a gear rigidly connected to the cylinder and having teeth on its periphery, a second gear operating to intermittently drive the first gear, and a constant-speed mechanism operating to drive the second gear and through it the cylinder, the cylinder being transferred from the bed to the constant-speed mechanism while it is running at considerable speed and before the bed reaches the end of its stroke, substantially as described.

7. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a continuously-rotating cylinder, means for driving the bed at a variable speed, means for driving the cylinder from the bed during a part only of the printing stroke, a gear rigidly connected to the cylinder and having teeth on its periphery, a second gear constantly in mesh with the first gear, and a constant-speed mechanism operating to intermittently drive the second gear and through it the cylinder, the cylinder being transferred from the bed to the constant-speed mechanism while it is running at considerable speed and before the bed reaches the end of its stroke, substantially as described.

8. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a continuously-rotating multirevolution-cylinder, means for driving the bed at a variable speed, means for driving the cylinder from the bed during a part only of the printing stroke, a gear rigidly connected to the cylinder and having teeth on its periphery, a second gear operating to intermittently drive the first gear, a constant-speed mechanism operating to drive the second gear and through it the cylinder, the cylinder being transferred from the bed to the constant-speed mechanism while it is running at considerable speed and before the bed reaches the end of its stroke, and means for separating the bed and cylinder during the return stroke of the bed, substantially as described.

9. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a continuously-rotating multirevolution-cylinder, means for driving the bed at a variable speed, means for driving the cylinder from the bed during a part only of the printing stroke, a gear rigidly connected to the cylin-

der and having teeth on its periphery, a second gear operating to intermittently drive the first gear, a constant-speed mechanism operating to drive the second gear and through it the cylinder, the cylinder being transferred from the bed to the constant-speed mechanism while it is running at considerable speed and before the bed reaches the end of its stroke, and raising and lowering devices for the cylinder.

10. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a continuously-rotating multirevolution-cylinder, means for driving the bed at a variable speed, means for driving the cylinder from the bed during a part only of the printing stroke, a gear rigidly connected to the cylinder and having teeth on its periphery, a second gear constantly in mesh with the first gear, a constant-speed mechanism operating to intermittently drive the second gear and through it the cylinder, the cylinder being transferred fron the bed to the constant-speed mechanism while it is running at considerable speed and before the bed reaches the end of its stroke, and raising and lowering devices for the cylinder, substantially as described.

11. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a continuously-rotating cylinder, means for driving the bed at a variable speed, means for driving the cylinder in synchronism with the bed during a part only of the printing stroke, a gear rigidly connected to the cylinder and having teeth on its periphery, a second gear in constant mesh with the first gear, and a constantly-running segmental gear operating to drive the second gear during the time when the cylinder is not driven by the variable-speed mechanism, substantially as described.

12. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a continuously-rotating cylinder, means for driving the bed at a variable speed, means for driving the cylinder from the bed during a part only of the printing stroke, a gear rigidly connected with the cylinder and having teeth on its periphery, a second gear in constant mesh with the first gear, and a constantly-running segmental gear operating to drive the second gear during the time when the cylinder is not driven by the bed, substantially as described.

13. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a continuously-rotating multirevolution-cylinder, means for driving the bed at a variable speed, means for driving the cylinder in synchronism with the bed during a part only of the printing stroke, a gear rigidly connected to the cylinder and having teeth on its periphery, a second gear in constant mesh with the first gear, a constantly-running segmental gear operating to drive the second gear during the time when the cylinder is not driven by the variable-speed mechanism, and raising and lowering devices for the cylinder, substantially as described.

14. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a continuously-rotating multirevolution-cylinder, means for driving the bed at a variable speed, means for driving the cylinder from the bed during a part only of the printing stroke, a gear rigidly connected with the cylinder and having teeth on its periphery, a second gear in constant mesh with the first gear, a constantly-running segmental gear operating to drive the second gear during the time when the cylinder is not driven by the bed, and raising and lowering devices for the cylinder, substantially as described.

15. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed having a rack, of means for driving it at a variable speed, a cylinder having a segmental gear meshing with the rack, whereby the cylinder is driven by the bed during a part only of its printing stroke, a driving-gear rigidly connected to the cylinder, an intermediate with which said gear is constantly in mesh, and a constantly-running segmental gear for driving the intermediate, substantially as described.

16. In a bed-and-cylinder printing-machine, the combination with a bed reciprocating in a right line, of a crank mechanism for driving it at the described variable speed, a rack on the bed having its teeth at its forward or engaging end enlarged, a cylinder having a segmental gear which has similarly-enlarged teeth, and a constant-speed mechanism for driving the cylinder when it is not driven by the bed, the cylinder being transferred from the bed to the constant-speed mechanism while it is running at a considerable speed and before the bed reaches the end of its stroke, substantially as described.

17. In a bed-and-cylinder printing-machine, the combination with a bed reciprocating in a right line, of a crank mechanism for driving it at the described variable speed, a continuously-rotating cylinder, means for driving it in synchronism with the bed during a part of the printing stroke, and a constant-speed mechanism for driving the cylinder when it is not driven by the bed, said mechanism including a segment and a gear, said segment and gear carrying supplementary curved racks with enlarged teeth, the cylinder being transferred from the variable-speed mechanism to the constant-speed mechanism while it is running at a considerable speed and before the bed reaches the end of its stroke, substantially as described.

18. The combination with a bed reciprocating in a right line, of a crank mechanism for driving it at the described variable speed, a rack thereon having its forward or engaging teeth enlarged, a cylinder having a segmental gear thereon, said gear having correspondingly-enlarged teeth, the rack and the

gear operating to drive the cylinder during a part of the printing stroke of the bed, and a constant-speed mechanism for driving the cylinder when it is not driven by the bed, said constant-speed mechanism including a gear and a segment, said gear and segment carrying supplementary curved racks having enlarged teeth, substantially as described.

19. The combination with a reciprocating bed, of a crank mechanism for driving it, a rack thereon having its forward or engaging teeth enlarged, a continuously-rotating multirevolution-cylinder having a segmental gear thereon, said gear having correspondingly-enlarged teeth, the rack and the gear operating to drive the cylinder during a part of the printing stroke of the bed, a constant-speed mechanism for driving the cylinder when it is not driven by the bed, said constant-speed mechanism including a gear and a segment, said gear and segment carrying supplementary curved racks having enlarged teeth, and raising and lowering devices for the cylinder, substantially as described.

20. In a bed-and-cylinder printing-machine, the combination with a continuously-rotating cylinder, of a reciprocating bed, a crank mechanism for driving the bed, rack-and-gear mechanism between the bed and cylinder, whereby the bed drives the cylinder during a part only of its printing stroke, a gear rigidly connected to the cylinder, a second gear in mesh with the first gear, raising and lowering devices for the cylinder and first gear, raising and lowering devices for the second gear, and means for driving the second gear at a constant speed when the cylinder is disengaged from the bed, the cylinder being transferred from the bed to the constant-speed gear while the cylinder is running at a considerable speed and before the bed reaches the end of its stroke, substantially as described.

21. In a bed-and-cylinder printing-machine, the combination with a continuously-rotating multirevolution-cylinder, of a reciprocating bed, a crank mechanism for driving the bed, rack-and-gear mechanism between the bed and cylinder, whereby the bed drives the cylinder during a part only of its printing stroke, a gear rigidly connected to the cylinder, a second gear in mesh with the first gear, raising and lowering devices for the cylinder and first gear, raising and lowering devices for the second gear, and means for driving the second gear at a constant speed when the cylinder is disengaged from the bed, the cylinder being transferred from the bed to the constant-speed gear while the cylinder is running at a considerable speed and before the bed reaches the end of its stroke, substantially as described.

22. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a crank mechanism for driving it, a continuously-rotating multirevolution-cylinder, rack-and-gear mechanism between the bed and the cylinder, whereby the bed drives the cylinder during part only of its printing stroke, a gear rigidly connected to the cylinder, a second gear, means for simultaneously raising and lowering the cylinder and the two gears, and means for driving the second gear at a constant speed when the cylinder is disengaged from the bed, the cylinder being transferred from the bed to the constant-speed gear while the cylinder is running at a considerable speed and before the bed reaches the end of its stroke, substantially as described.

23. The combination with a cylinder, of a gear by which the cylinder is rotated, a second gear for rotating the cylinder-gear, raising and lowering devices for the cylinder, and independent raising and lowering devices for the second gear, substantially as described.

24. The combination with a cylinder, of a gear by which the cylinder is rotated, a second gear for rotating the cylinder-gear, a shaft, raising and lowering devices for the cylinder operated from said shaft, independent raising and lowering devices for the second gear and means also operated from said shaft whereby said raising and lowering devices for the second gear are operated, substantially as described.

25. The combination with a cylinder, of a gear for rotating the same, a second gear for rotating the cylinder-gear, an operating-gear for rotating the second gear, raising and lowering devices for the cylinder, independent raising and lowering devices for the second gear, said raising and lowering devices operating to move the gear on a diagonal line, whereby it is retained in mesh both with the cylinder-gear and the operating-gear, substantially as described.

26. The combination with a cylinder, of a gear mounted on the shaft thereof, a second gear for rotating the cylinder-gear, raising and lowering devices for the cylinder, a shaft from which these devices are operated, raising and lowering devices for the second gear, a shaft for controlling these raising and lowering devices, and connections between the two shafts whereby the raising and lowering devices are simultaneously operated, substantially as described.

27. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a crank mechanism for driving it, a rack on the bed, a multirevolution continuously-rotating cylinder, a segment meshing with the rack on the bed, whereby the cylinder is driven by the rack during a part of the printing stroke of the bed, a gear rigidly connected to the cylinder, raising and lowering devices for the cylinder and the gear, a second gear constantly in mesh with the first gear, raising and lowering devices for said second gear, connections between the raising and lowering devices for said second gear and the raising and lowering devices for the cylinder and gear, whereby they are simultane-

ously operated, and a segmental gear on the crank-shaft for driving the second gear during the time when the cylinder is not driven by the bed, substantially as described.

28. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of a crank mechanism for driving it, a multirevolution continuously-rotating cylinder coöperating therewith, a rack on the bed having the teeth on its forward or engaging end enlarged, a segment on the cylinder engaging the rack and having the teeth at its engaging end similarly enlarged, a gear rigidly connected to the cylinder-shaft, a second gear with which the first gear is constantly in mesh, raising and lowering devices for the cylinder and the gear on its shaft, raising and lowering devices for the second gear, connections between the two sets of raising and lowering devices whereby they are simultaneously operated, a segmental gear mounted on the crank-shaft for driving the second gear when the cylinder is disengaged from the bed, the segmental gear and the second gear having supplementary curved racks with enlarged teeth, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

THOMAS M. NORTH.

Witnesses:
F. W. H. CRANE,
L. ROEHM.