

No. 666,324.

Patented Jan. 22, 1901.

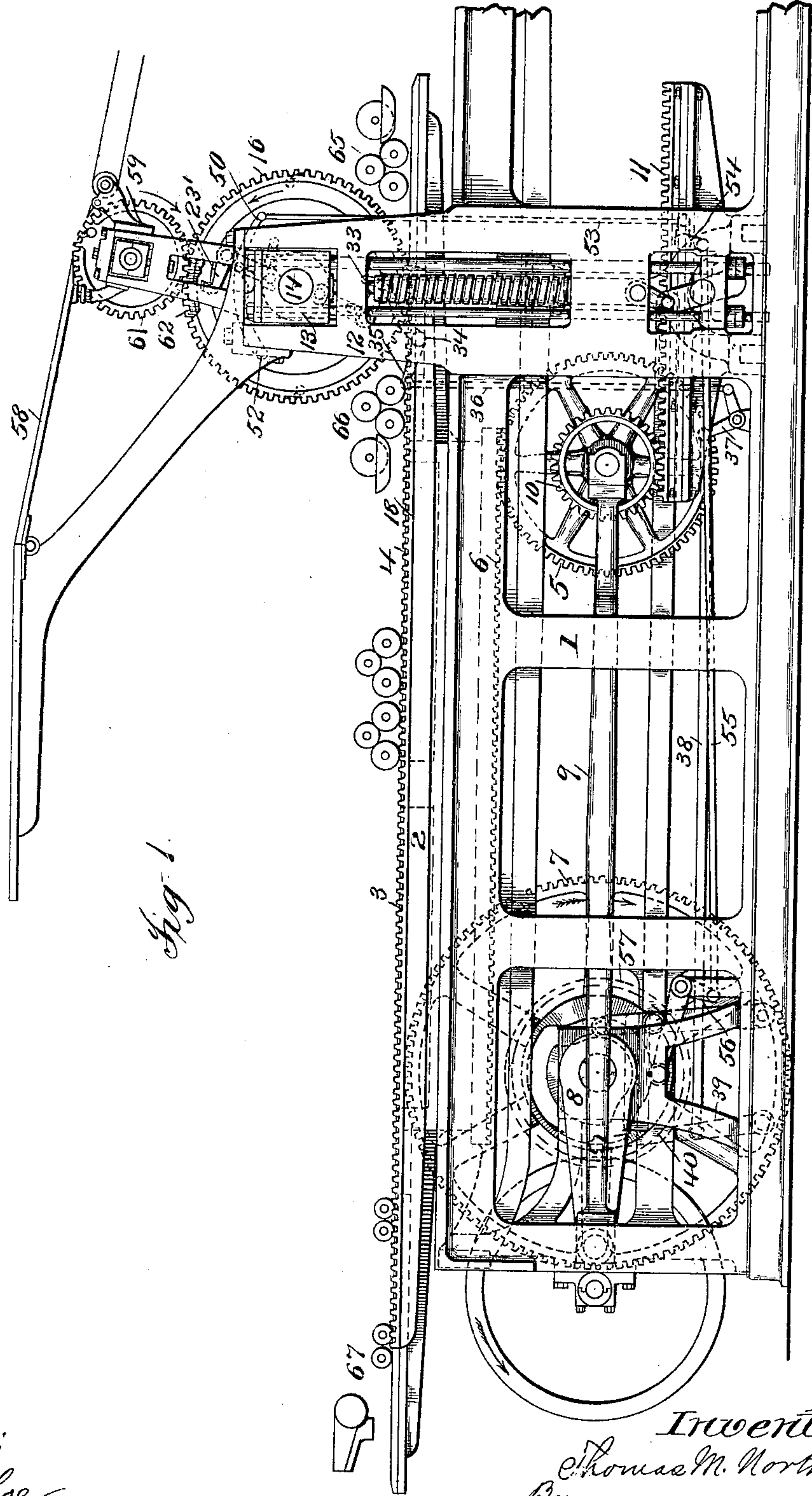
T. M. NORTH.

MULTICOLOR BED AND CYLINDER PRINTING MACHINE.

(Application filed Oct. 14, 1898.)

(No Model.)

6 Sheets—Sheet 1.



Attest:
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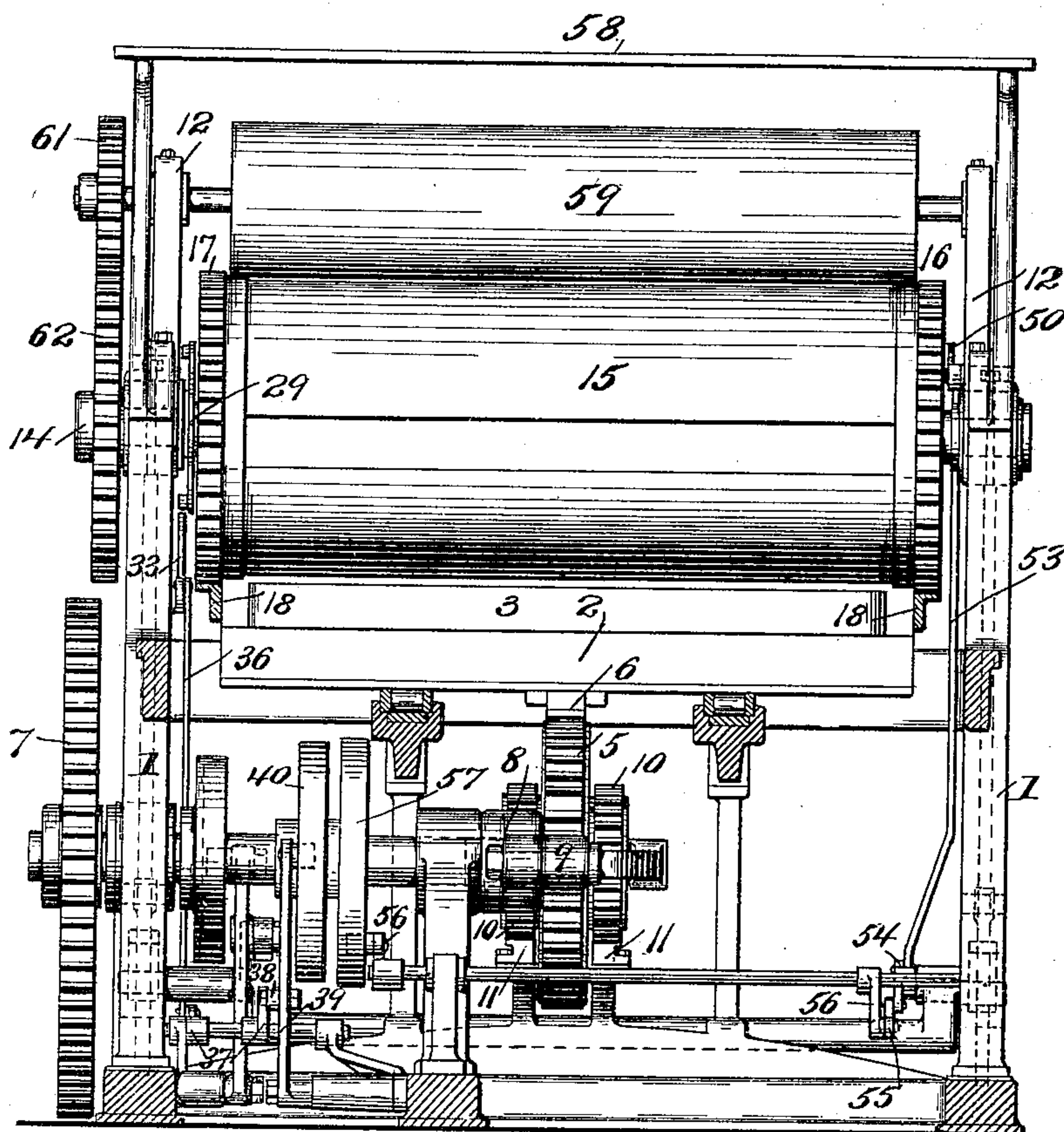
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6 Sheets—Sheet 2

Fig. 2.



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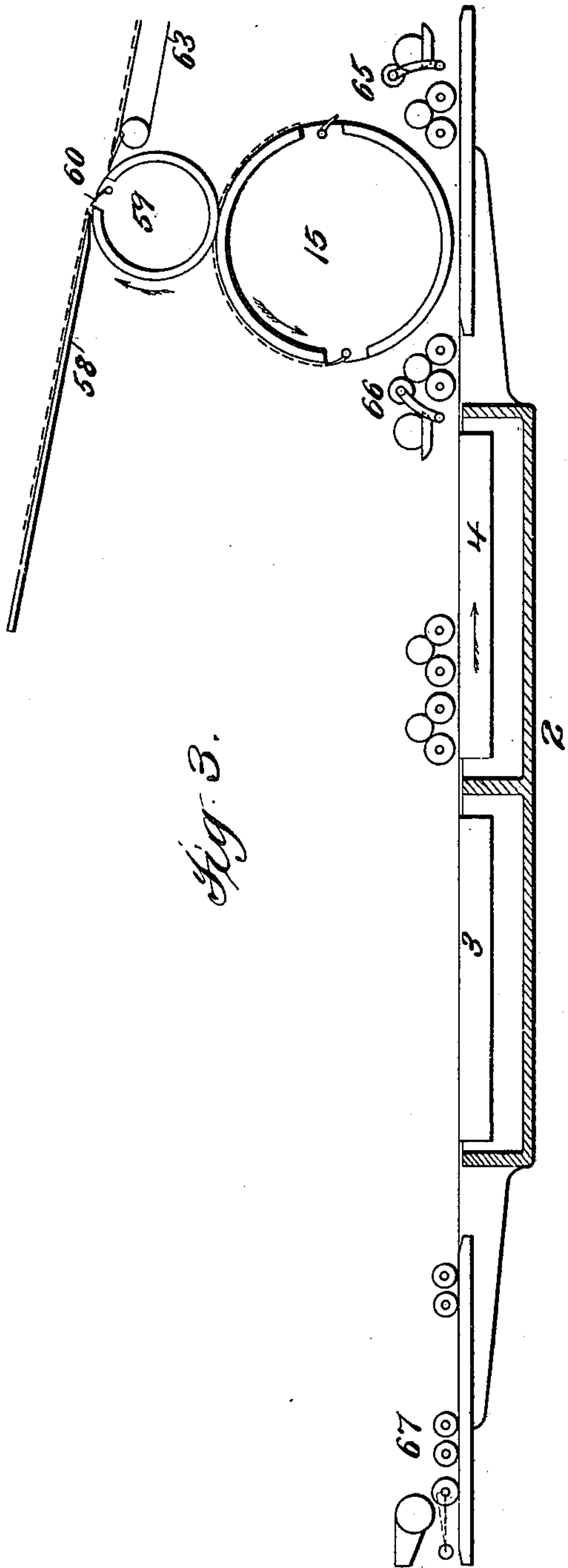


Fig. 3.

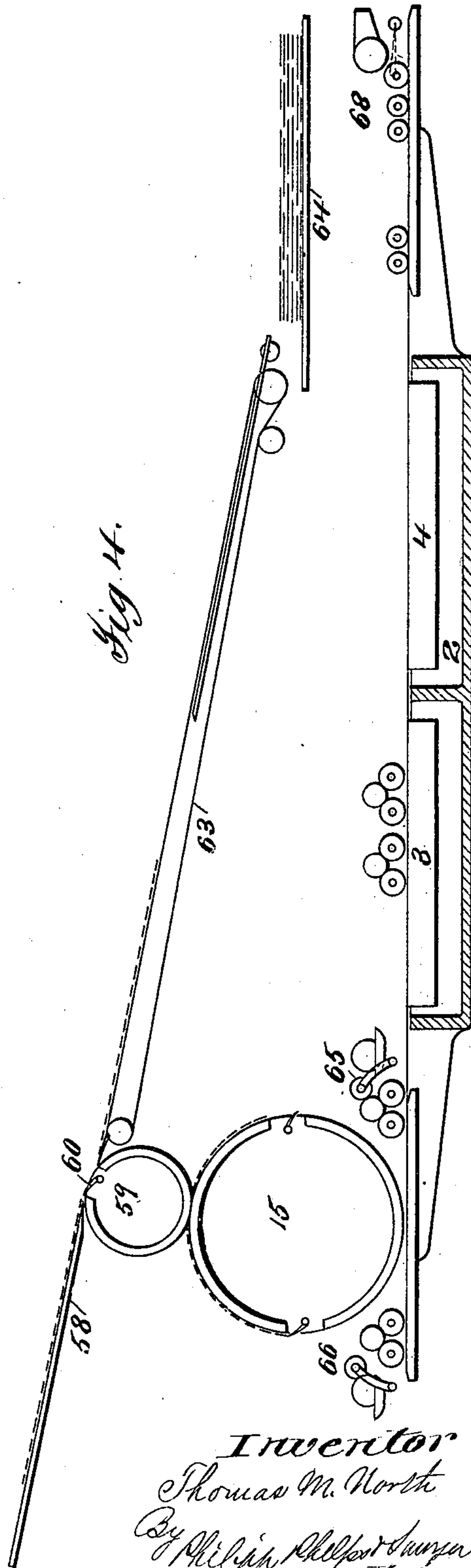


Fig. 4.

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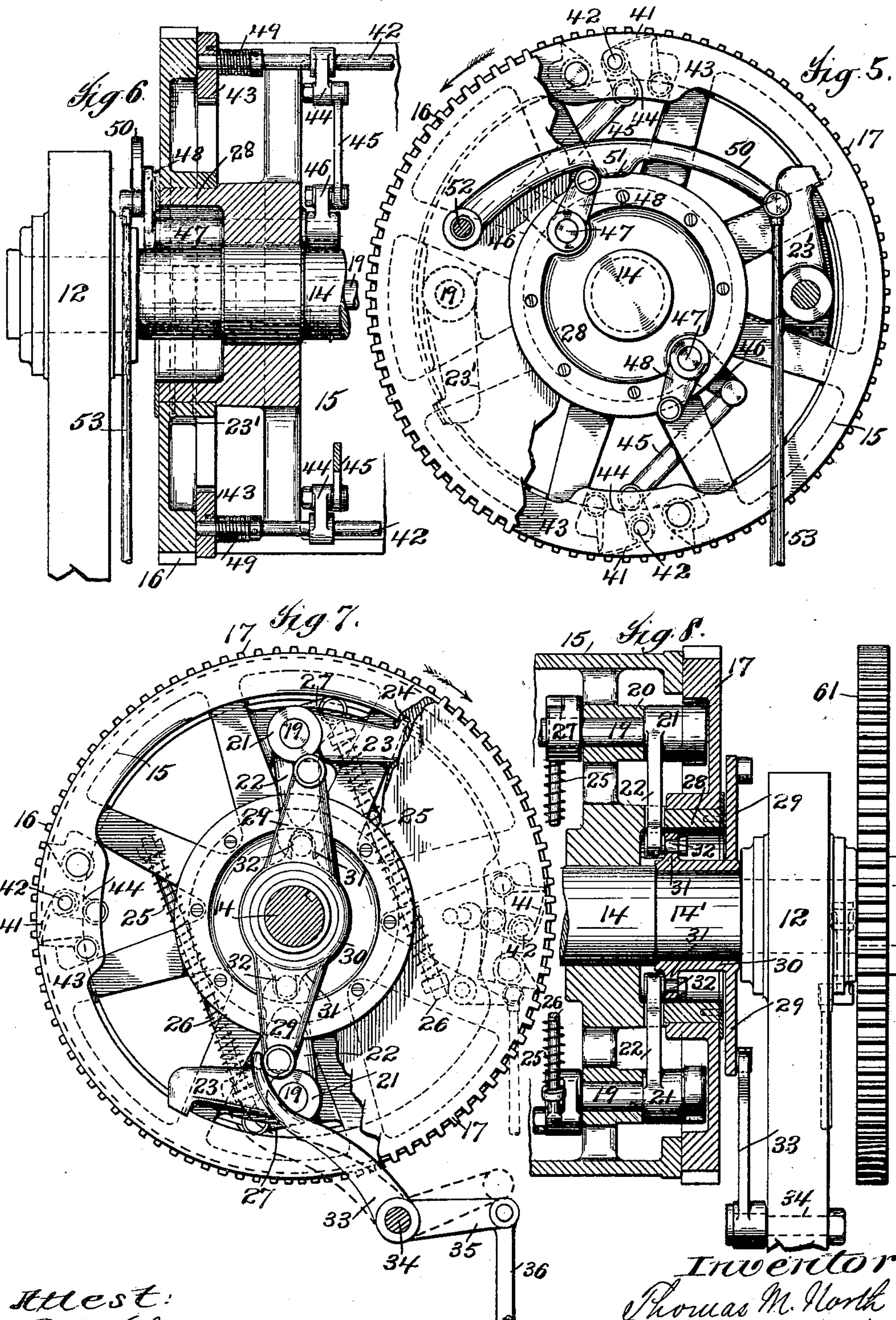
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6 Sheets—Sheet 4.



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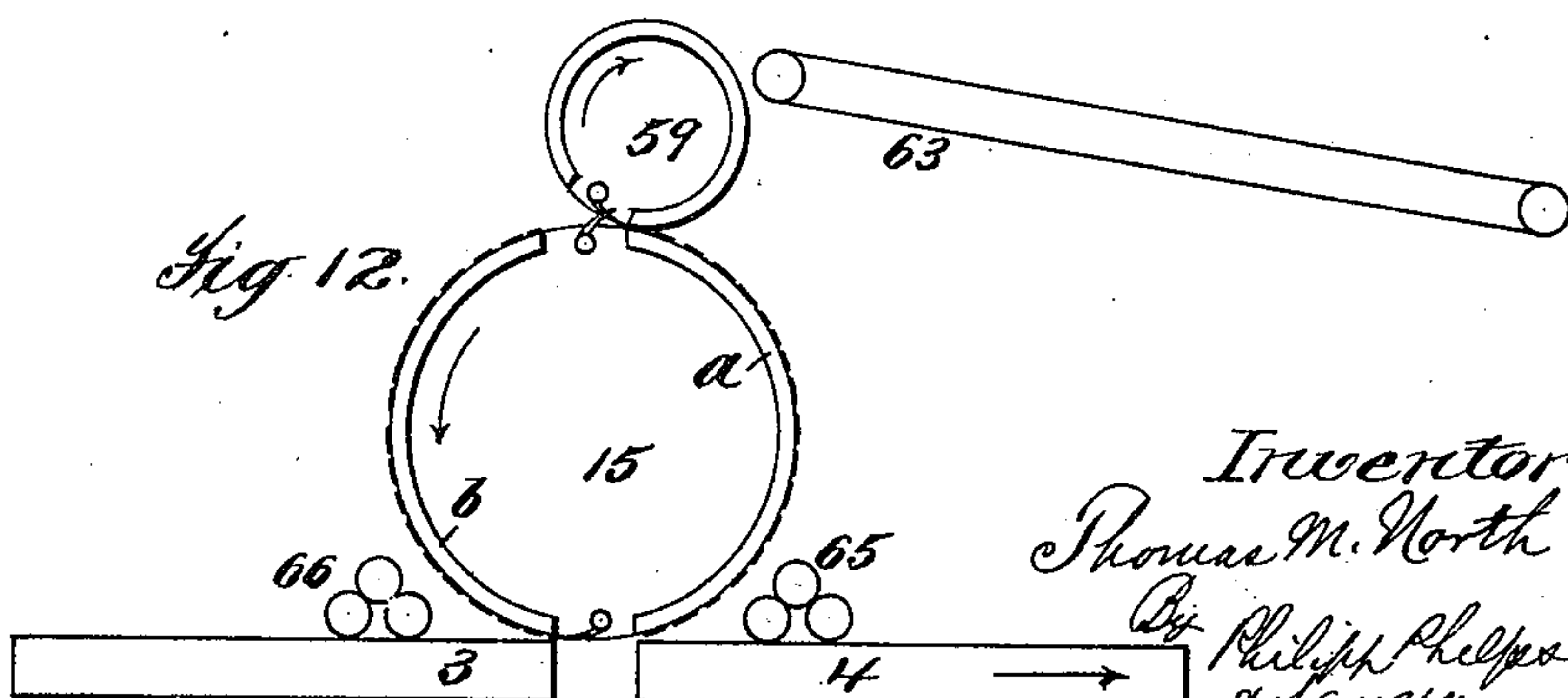
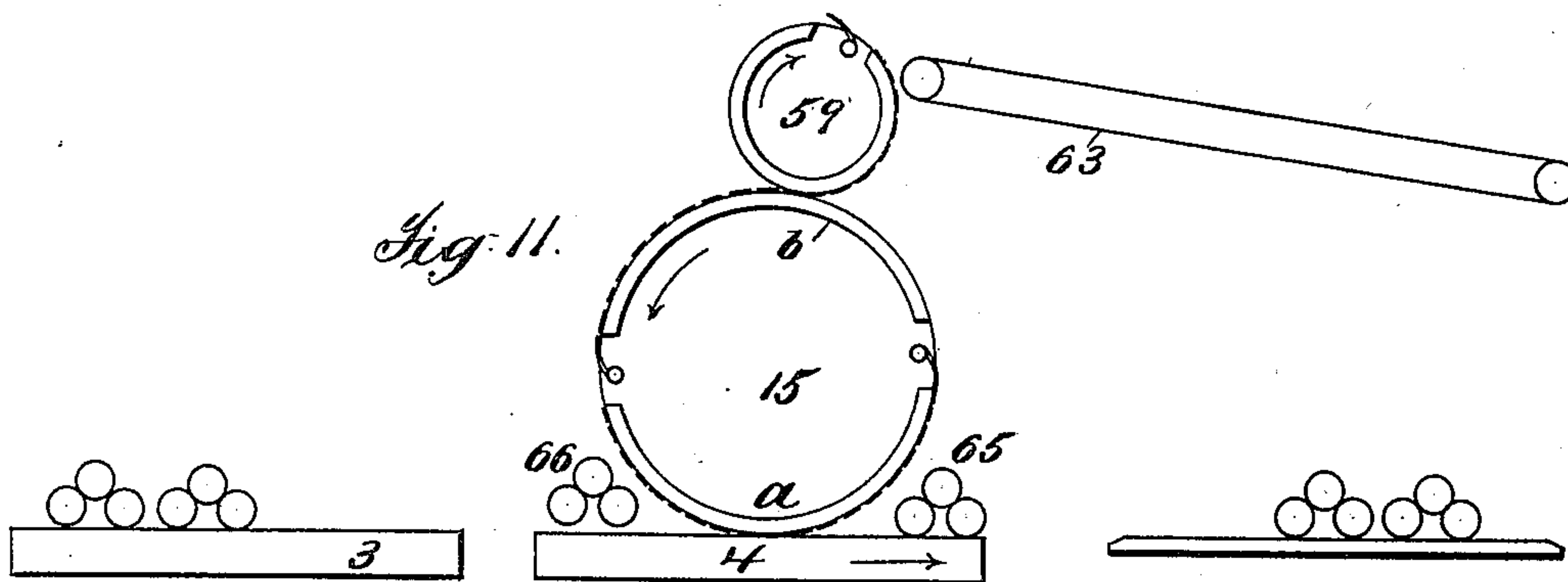
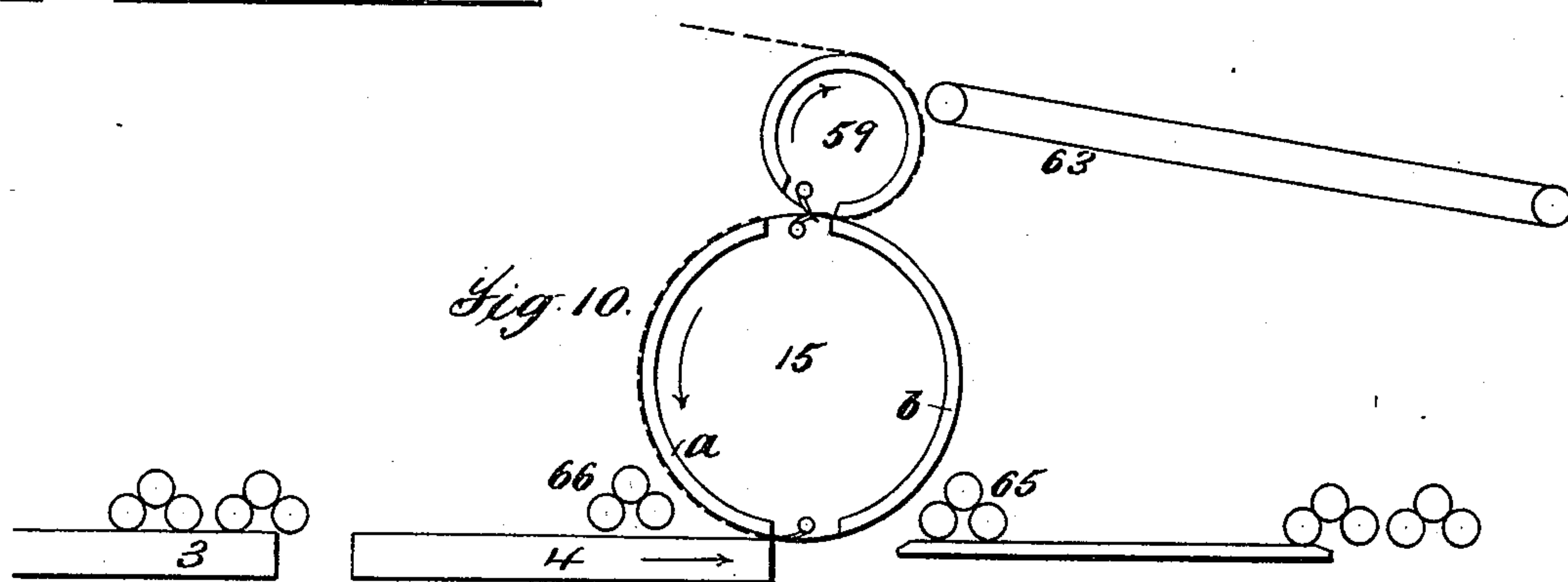
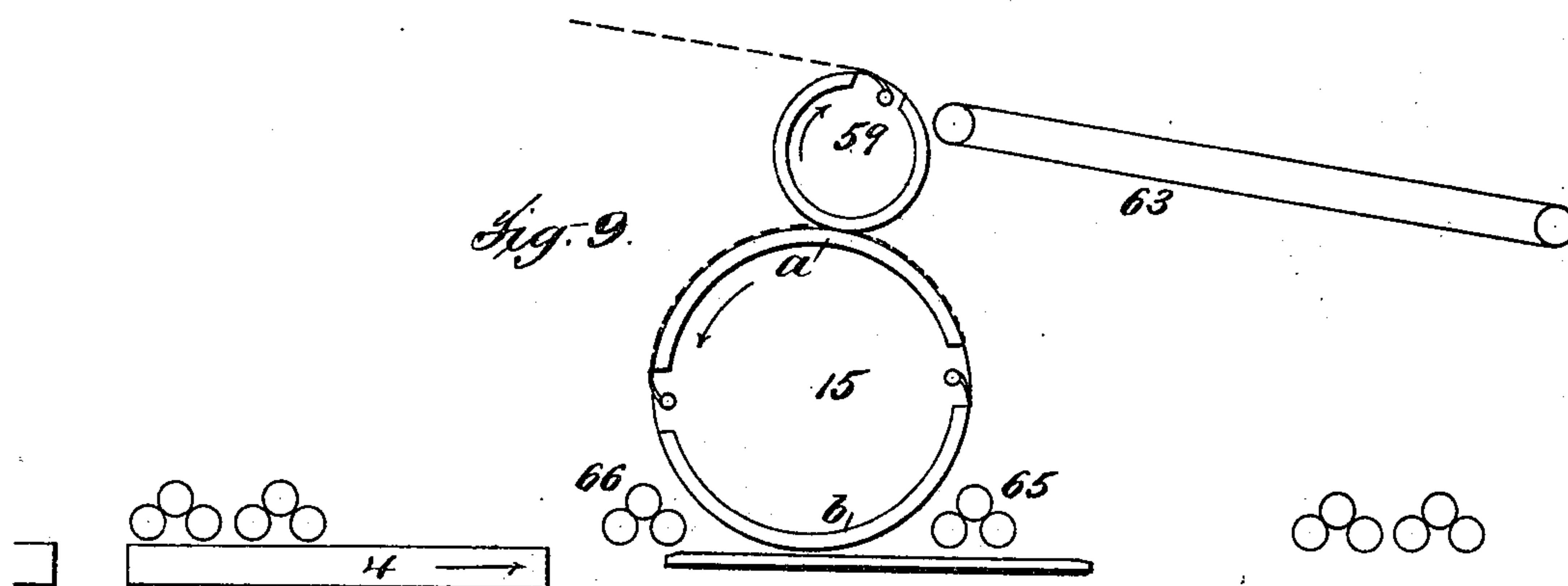
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(No Model.)

6 Sheets—Sheet 5.



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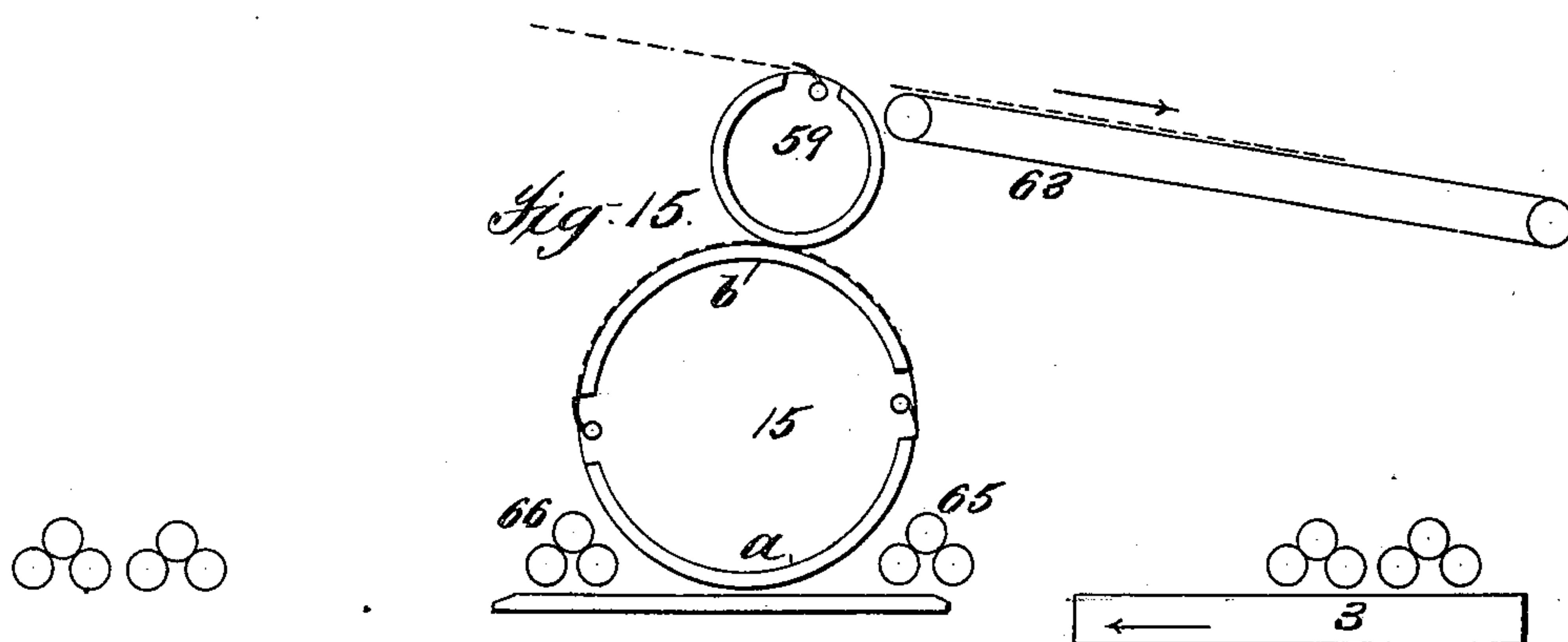
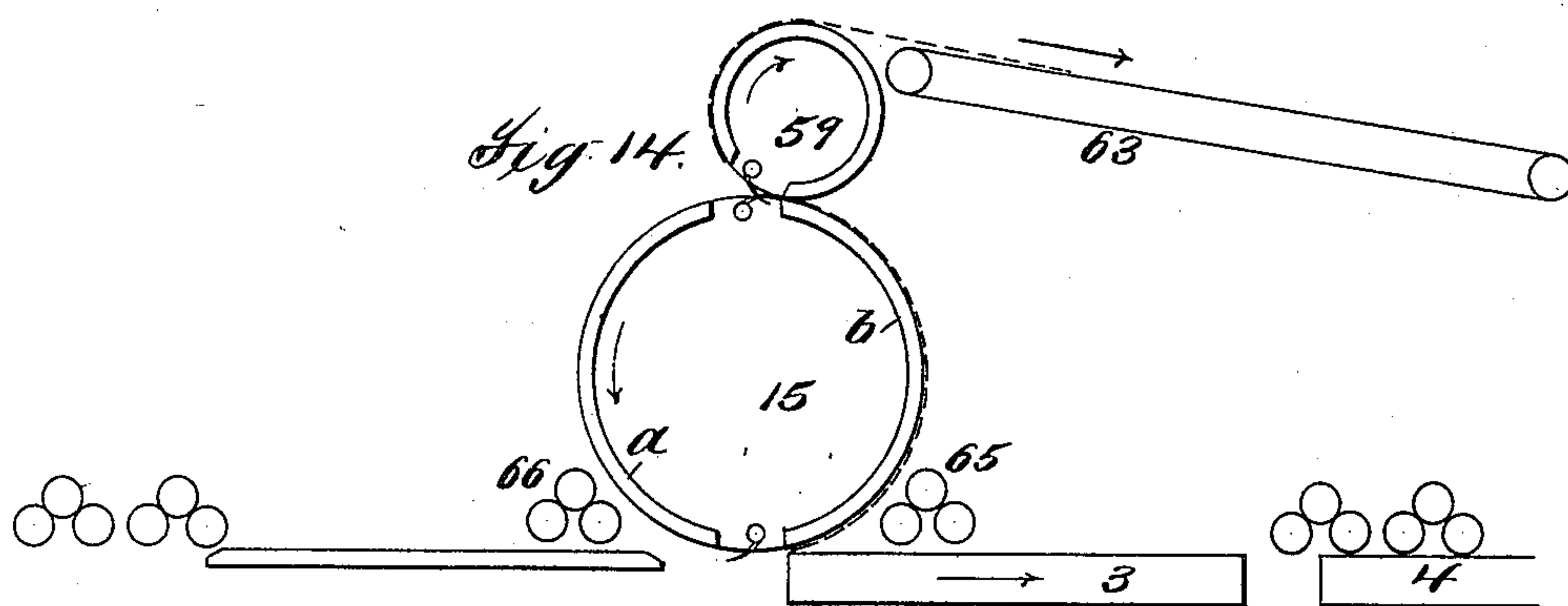
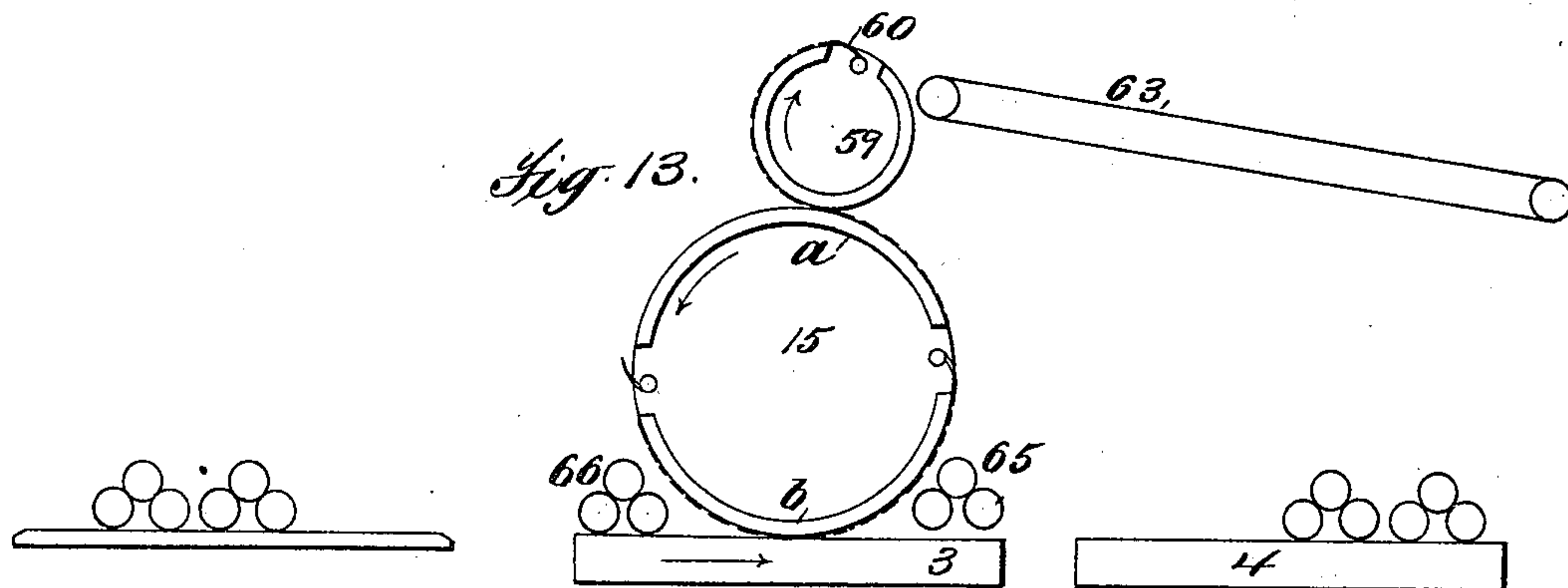
T. M. NORTH.

MULTICOLOR BED AND CYLINDER PRINTING MACHINE.

(Application filed Oct. 14, 1898.)

(No Model.)

6 Sheets—Sheet 6.



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UNITED STATES PATENT OFFICE.

THOMAS M. NORTH, OF NEW YORK, N. Y., ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO ROBERT HOE AND CHARLES W. CARPENTER, OF SAME PLACE.

MULTICOLOR BED-AND-CYLINDER PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 666,324, dated January 22, 1901.

Application filed October 14, 1898. Serial No. 693,494. (No model.)

To all whom it may concern:

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

This invention relates to certain improvements in printing-machines, and more particularly to bed-and-cylinder machines employing planographic printing-surfaces and
15 printing in a plurality of colors.

Many attempts have been made to adapt bed-and-cylinder machines to multicolor-printing. Such machines have been constructed with a plurality of beds and a plurality of cylinders, one for each bed, the sheet
20 being fed first to one cylinder and printed by it and its cooperating bed and then being transferred directly or indirectly to the next cylinder, which, with its cooperating bed, gives it
25 a second impression in a different color. Machines of this character are expensive to build, because of the number of impression-cylinders and because of the complicated mechanisms necessary to operate the cylinders, and are also exceedingly bulky. Furthermore, exceedingly-accurate register is
30 necessary for good color-printing, and great difficulty has been found in successfully transferring the sheets from cylinder to cylinder either directly or by intermediate devices and at the same time preserving that absolute accuracy of register which is necessary for fine
35 work. Attempts have also been made to employ a single cylinder having a plurality of impression-surfaces which cooperate with a plurality of printing-surfaces on the bed. In some of these machines the sheet after receiving an impression from one impression-surface and the cooperating printing-surface
40 on the bed has been transferred to a second cylinder, which receives it and returns it to the next impression-surface on the cylinder in position to receive a second impression from the next impression-surface and print-

ing-surface on the bed. In these machines
50 the difficulties heretofore referred to have been experienced. The machines are complicated and expensive, and, furthermore, the accurate register which must be maintained for successful results is liable to be lost in
55 transferring the sheets from one cylinder to the other.

In endeavoring to avoid the difficulties which have been referred to the use of machines employing a continuously-revolving
60 cylinder having a plurality of impression-surfaces cooperating with a plurality of printing-surfaces on the bed, the sheet remaining on the impression-surface and being successively presented to the printing-surfaces, has
65 also been suggested. In these machines, however, as it has been proposed to construct them, the impression-surfaces have been separated from each other a distance at least equal to the length of each surface and the printing-surfaces on the bed have been similarly
70 separated, such separation of the surfaces having been considered necessary in order to bring the impression-surfaces into contact with the printing-surfaces in the proper sequence. The printing-surfaces in bed-and-cylinder machines are, however, of considerable length, sometimes reaching forty inches. In a machine of the type referred to the circumference of the cylinder having two impression-surfaces must be at least four times
80 the length of the impression-surface and the travel of the bed must be equal to the circumference of the cylinder. It follows, therefore, that such constructions are not adapted
85 for printing except from the very smallest forms on account of the necessarily great diameter of the cylinder and the great length of travel which must be given to the bed. This class of machines, therefore, has little or
90 no practical value. Attempts have been made to remedy one of the difficulties—namely, the length of travel of the bed—by giving the printing-surfaces an independent movement with respect to the reciprocating bed. In
95 these constructions, however, the cylinder must still be of excessive diameter if forms of any considerable length are to be printed

from and the mechanism necessary to give the printing-surfaces the necessary independent movement has been of a very complicated nature. These machines are therefore open
5 to as many practical objections as the machines which they were devised to replace.

It is the object of this invention to produce a bed-and-cylinder machine for multicolor-printing in which a plurality of impression-
10 surfaces on a single cylinder shall cooperate with a plurality of printing-surfaces on a bed to give a sheet a plurality of impressions usually in different colors and do this without removing the sheet from the impression-
15 surface until it has received the desired number of impressions and at the same time to produce a machine in which the circumference of the cylinder need be no greater than the combined length of the impression-sur-
20 faces plus the necessary space for the openings in which the sheet-taking devices operate and in which the length of travel given the bed is substantially only equal to the combined length of the form-surfaces.

25 The invention consists in certain parts, improvements, and combinations, which will be hereinafter described, and fully pointed out in the claims hereunto appended.

In the accompanying drawings, which represent a printing-machine constructed according to the present invention and in which like characters of reference indicate the same parts, Figure 1 represent a side view of a bed-and-cylinder machine embodying the invention.
30 Fig. 2 represents an end view of the machine, with certain parts in section. Figs. 3 and 4 are diagrammatic side views showing the relation of the cylinders and the beds and also the feeding-in and feeding-out cylinder.
40 Fig. 5 represents an end view of the cylinder, with certain parts broken away to show more particularly the mechanism for operating the grippers. Fig. 6 is a vertical central section of the construction shown in Fig. 5. Fig. 7
45 is a view on the opposite end of the cylinder, showing the mechanism by which the operating-gear is locked to and unlocked from the cylinder. Fig. 8 is a vertical central section of the construction shown in Fig. 7. Figs. 9,
50 10, 11, 12, 13, 14, and 15 are diagrammatic views illustrating the position of the cylinder, with reference to the feeding mechanism and the printing-surface on the bed at various points in the operation of the machine.

55 Referring to Fig. 1, in which a machine is shown which represents one embodiment of the invention, 1 indicates the frame of a machine of the stop-cylinder type, and 2 indicates the bed of the machine, which in the
60 present case is provided with two printing-surfaces 3 and 4. While these printing-surfaces may be of any of the known types, they are herein shown as lithographic stones. The bed 2 is operated from a railroad-gear 5, which
65 meshes with a rack 6 on the bed, the gear being given its movement from a large gear 7,

carrying a crank-arm 8, the arm being connected to the gear 5 by a connecting-rod 9. The shaft which carries the gear 5 is also provided with two small gears 10, which mesh
70 with racks 11, supported on the machine-frame, the racks and gears serving to multiply the movement of the railroad-gear 5 in a well-known manner.

The frame of the machine has standards 12,
75 which are provided at their upper ends with ways in which slide boxes 13, in which the shaft 14 of the impression-cylinder 15 is mounted. The boxes are given a slight vertical movement by a toggle mechanism, which
80 is of a type well known in the art and which need not therefore be specifically described.

The impression-cylinder 15 carries a pair of large gears 16 and 17, which gears mesh with racks 18 on the bed, these gears being
85 mounted on recessed hubs 29. These gears serve to transmit the movement of the bed to the cylinder. In the form of machine shown these gears are constantly in mesh with the racks 18 on the bed, the raising-and-
90 lowering mechanism before described giving a movement to the cylinder which is sufficient to raise it off impression in order to permit the return of the bed, but which is not sufficient to raise the gears 16 and 17 out of mesh
95 with the racks. Inasmuch as the cylinder is a stop-cylinder it is necessary, therefore, that these gears be so connected to the cylinder as to enable them to run loose while the bed is returning and to be locked to the cylinder
100 while the bed is making its printing stroke.

In order to provide for the loose movement of the gears just referred to, the cylinder 15 is provided (see Figs. 7 and 8) with two rock-shafts 19, which are shown as journaled in
105 bearings 20, which are or may be attached to spokes of the cylinder. These shafts carry at one end bell-crank levers 21, having arms 22 23. The arms 23 are locking-arms and engage with suitable notches 24, formed in
110 the inner rim of the gear. The shafts 19 are rocked, so as to hold the arms 23 of the bell-cranks in locking engagement by means of springs 25, mounted on rods 26, which are
115 pivotally connected to rock-arms 27 on the shafts 19. The other ends of the rods 26 pass loosely through guides, the manner of the operation of the springs being obvious.

As has been stated, the cylinder is provided with recessed hubs 28 and the ends of the
120 arms 22 extend into the recess of the hub on which the gear 17 is mounted. Mounted on a reduced portion 14' of the shaft 14 is a two-armed lever 29, having a hub or collar 30, which collar lies in the recess of the cylinder-
125 hub 28, before referred to. This collar 30 is provided with two projections 31, having perforations therein, in which perforations are mounted pins 32. These pins 32 are engaged by yoke-shaped recesses in the ends of the
130 arms 22. It is obvious that by rocking the two-armed lever 29 the bell-cranks 21 and the

shafts 19 will be rocked and the locking-arms 23 of the bell-cranks will be disengaged from the notches 24 in the gears.

In order to rock the two-armed lever 29, there is provided a cam 33, which is in the form of a bell-crank and is pivoted on a stud 34, which projects from one of the standards of the machine. The other arm 35 of the bell-crank is connected by a rod 36 to a bell-crank 37. This bell-crank 37 is connected by a rod 38 to a lever 39, pivoted on the base of the machine, this lever being operated at proper times by a cam 40, mounted on the shaft of the gear 7. This cam is so shaped that it will, through the connections described, throw the cam 33 into the path of the two-armed lever 29 and rock it, thereby throwing the locking-arms 23 out of their notches, and thus releasing the gear 17 from the cylinder.

The shafts 19 extend across the cylinder, and they are provided on the ends which are next the gear 16 with arms 23', which engage notches in this gear. The movement of the shaft which throws the arms 23 and releases the gear 17 will also throw the arms 23' and release the gear 16.

The machine must necessarily be provided with devices for taking and retaining the sheets during the successive impressions, and the mechanism shown is a gripper mechanism, although other retaining devices might be used.

Owing to the fact that the gears 16 and 17 are loose with respect to the cylinder during the return stroke of the bed, it is obvious that the ordinary gripper mechanism operated by a tumbler-block lying on the outside of the cylinder cannot be used. The grippers 41 (see Figs. 5 and 6) are therefore mounted on a shaft 42, which finds its bearings in heads 43 of the cylinder. The shafts 42 have rock-arms 44, which are connected by links 45 to arms 46. These arms 46 are carried on shafts 47, which extend through the hubs of the cylinders and are provided on their outer ends with rock-arms 48. The grippers are held closed by torsional springs 49, one end of which is secured in the heads 43 and the other to collars on the shafts 42. In order to open the grippers at the proper time, the shafts 47 must be rocked. Provision is made for rocking said shafts through an arm 50, which carries a cam projection 51 and is pivoted to the stud 52 on a side frame of the machine. Connected to the opposite end of the arm 50 is a link 53, which is connected to a bell-crank 54, pivoted on one of the standards of the frame. The bell-crank 54 is connected by a rod 55 to another bell-crank 56, which is operated by a cam 57, mounted on the shaft of the gear-wheel 7. This cam is of a proper configuration to give the grippers the necessary movements to take and deliver the sheets, as will be hereinafter described.

The sheets to be printed may be fed to the machine in any suitable manner. Prefer-

ably, however, there is provided a feed-board 58, over which the sheets pass to a cylinder 59, provided with grippers 60. The cylinder 59 is operated by a gear 61, which engages with a gear 62 on the outer end of the cylinder-shaft 14. (See Fig. 2.) Other means may be provided for operating the cylinder 59, but the construction above described is simple and effective. The cylinder 59 also operates as a delivery-cylinder, the sheets being taken therefrom in any suitable manner. Preferably, however, there is provided a set of delivery-tapes 63, which deposit the sheets on a suitably-located table 64. The machine is provided with wetting devices, which are herein shown as rolls 65 66, one set of rolls operating in connection with each of the stones, and the machine also has two sets of inking devices 67 68, these devices being located at opposite ends of the machine and each device supplying the color to one of the stones 3 4.

The operation of the machine will be well understood by reference to the diagrams shown in Figs. 9 to 15, inclusive. In Fig. 9 the bed is shown at the end of its return stroke and the first impression-surface *a* of the cylinder 15 is shown as having taken a sheet, which may be considered as having already received an impression. The bed now moves to the right of the observer, as shown in Fig. 10, which figure represents the position of the parts after the cylinder has made a quarter of a revolution. The sheet on the impression-surface *a* is now coming in contact with the printing-surface 4 in order to receive its second color. At about this time the second impression-surface *b* takes its sheet from the cylinder 59. The bed continues its movement to the right through the position shown in Fig. 11, when the impression-surface *a* is in contact with the printing-surface 4 and the impression-surface *b* is taking the sheet from the cylinder 59 to the position shown in Fig. 12. In this position the sheet on the impression-surface *b* has just come into contact with the printing-surface 3 to receive its first impression. The sheet on the impression-surface *a* having now received its second printing from the printing-surface 4 is about to be delivered to the cylinder 59, which in turn is to transfer it to the delivery-tapes 63. In the position of the parts shown in Fig. 13 the sheet on the impression-surface *b* is receiving its first impression from the printing-surface 3 and the twice-printed sheet on the impression-surface *a* is being delivered by the cylinder 59 during the next quarter-revolution. As shown in Fig. 14, the first printing of the sheet on the impression-surface *b* has been completed by the printing-surface 3 and the impression-surface *a* has given up its sheet to the cylinder 59. In Fig. 16 the bed is shown as having completed its stroke to the right, at which time the bell-crank levers 21 have been rocked by the two-armed levers 29 and the cam 33, so that the gears 16 and 17 are unlocked from the

cylinder. At this time the cylinder has made a revolution and a half, the sheet on the impression-surface *b* occupying the same position that the sheet on the impression-surface *a* occupied at the start of the cycle of operations described. The impression-cylinder is now slightly lifted by its toggle mechanism, so that its surface *a* will be off impression and the bed completes its return movement.

Proper mechanism must of course be provided to manipulate the inking and wetting mechanisms, so that they will come into operation at the proper time and so that each will operate only in connection with its own printing-surface. There are many mechanisms which are well known in the art for accomplishing this manipulation of the inking and wetting devices, and as they are not necessary to an understanding of the invention they have not been here shown. Preferably, however, the mechanisms which will be employed are substantially like those shown in my application, Serial No. 721,046 filed June 19, 1899.

It will be seen that in the machine described two sheets are printed in different colors for each printing stroke of the bed and that one sheet is completely printed in two colors on each second stroke of the bed, this being accomplished without removing the sheets from the cylinder and without leaving any waste space on the cylinder. The entire circumference of the cylinder except that necessarily utilized for the gripper-gaps is occupied by the impression-surfaces, and it is thus possible to keep the size of the cylinder within reasonable bounds and to very materially reduce the travel of the bed. More than two impression-surfaces might be provided on the cylinder, the bed in such cases of course being provided with as many printing-surfaces as the cylinder has impression-surfaces. In the present case where two impression-surfaces are employed the cylinder makes a revolution and a half. In case three impression-surfaces and cooperating printing-surfaces are employed the cylinder would make a revolution and a third, and in general the cylinder will make a complete revolution and will revolve in addition an amount substantially equal to the length of one of its impression-surfaces.

The details by which the invention is carried into effect may be widely varied, and it is understood, therefore, that the invention is not to be limited to the particular devices shown and described. Certain parts of the mechanism shown and described are also capable of use in relations other than those in which they are herein shown, and it is to be understood that such use is contemplated.

What I claim is—

1. The combination with a stop-cylinder, of a bed, the cylinder and bed each carrying a plurality of printing or impression surfaces, of means whereby the said surfaces are caused to cooperate alternately on each printing stroke of the bed, substantially as described.

2. The combination with a stop-cylinder, of a bed, the cylinder and bed each carrying a plurality of printing or impression surfaces, and means for causing the cylinder to make more than one complete revolution for each printing stroke of the bed, whereby the printing and impression surfaces are caused to cooperate alternately on each printing stroke of the bed, substantially as described.

3. The combination with a stop-cylinder having a plurality of impression-surfaces, of a bed having a plurality of cooperating printing-surfaces, means whereby the cylinder is caused to make a complete revolution and to revolve in addition an amount substantially equal to the length of one of the impression-surfaces, whereby the printing and impression surfaces are alternately brought into printing relation on each printing stroke of the bed, substantially as described.

4. The combination with a stop-cylinder having a plurality of impression-surfaces arranged at a distance from each other which is less than the length of one of said surfaces, of a bed carrying a series of forms, and means for causing said surfaces to cooperate alternately on each printing stroke of the bed, substantially as described.

5. The combination with a cylinder having a plurality of impression-surfaces and carrying sheet-retaining devices, the said surfaces being arranged close together except for a space in which the retaining devices operate, of a bed carrying a plurality of forms, means for causing the impression-surfaces on the cylinder to cooperate with said forms in succession, and means for operating the retaining devices to take and retain a sheet until it has been brought into contact with each printing-surface, substantially as described.

6. The combination with a stop-cylinder having a plurality of impression-surfaces and carrying sheet-retaining devices, the said surfaces being arranged close together except for a space in which the retaining devices operate, of a bed carrying a plurality of forms, and means for causing the impression-surfaces on the cylinder to cooperate with said forms in succession, substantially as described.

7. The combination with a stop-cylinder having a plurality of impression-surfaces and carrying sheet-retaining devices, the said surfaces being arranged close together except for a space in which the retaining devices operate, of a bed carrying a plurality of forms, means for causing the impression-surfaces on the cylinder to cooperate with said forms in succession, and means for operating the retaining devices to take and retain a sheet until it has been brought into contact with each printing-surface, substantially as described.

8. The combination with a cylinder carrying grippers and having a plurality of impression-surfaces arranged close together but with sufficient space between them to form

gripper-gaps, of a bed having a plurality of printing-surfaces, means for causing the cylinder to make more than a complete revolution for each printing stroke of the bed, and means for causing the grippers to take and retain a sheet until it has been brought into contact with each printing-surface, substantially as described.

9. The combination with a stop-cylinder carrying grippers and having a plurality of impression-surfaces arranged close together but with a sufficient space between them to form gripper-gaps, of a bed having a series of printing-surfaces, and means for causing the cylinder to make more than a complete revolution during each printing stroke of the bed, whereby said printing and impression surfaces are brought into operative relation alternately for each printing stroke of the bed, substantially as described.

10. The combination with a cylinder carrying grippers and having two impression-surfaces separated by a distance substantially equal to the gripper-gaps, of a bed carrying two printing-surfaces, there being a space between them equal to the space between the impression-surfaces, and means whereby the cylinder is caused to make a revolution and a half for each printing stroke of the bed, substantially as described.

11. The combination with a cylinder, of a bed, the cylinder and bed being provided with a plurality of printing or impression surfaces, means whereby the said surfaces are alternately brought into printing relation on each printing stroke of the bed, means operating both to feed sheets to and deliver them from said cylinder, and means for retaining the sheets on the cylinder until they have been brought into contact with each printing-surface, substantially as described.

12. The combination with a bed carrying a plurality of printing-surfaces, of a cylinder having a plurality of impression-surfaces and provided with sheet receiving and retaining devices located between the surfaces, of means for causing said printing and impression surfaces to alternately come into printing relation on each printing stroke of the bed, a cylinder provided with sheet taking and delivering devices and operating to feed sheets to and deliver them from the impression-cylinder, and means for causing the receiving and retaining devices to receive and retain a sheet until it has been brought into contact with each printing-surface, substantially as described.

13. The combination with a stop-cylinder having grippers and a plurality of impression-surfaces arranged close together except for the gripper-gaps, of a bed having a plurality of impression-surfaces, means whereby the impression-surfaces on the cylinder are alternately brought into coöperation with the printing-surfaces on the bed during each printing stroke of the bed, means whereby sheets may be fed to and delivered from said

impression-cylinder, and operating means for the grippers acting to hold them closed after taking a sheet until the sheet has been brought into contact with each printing-surface, substantially as described.

14. The combination with a stop-cylinder having grippers and a plurality of impression-surfaces, said impression-surfaces being spaced apart a distance substantially equal to the gripper-gaps, of a bed having a plurality of printing-surfaces, means whereby the impression-surfaces on the cylinder are alternately brought into printing relation during each printing stroke of the bed, and a cylinder having grippers operating to feed sheets to and deliver them from said impression-cylinder, said cylinder being operated from the impression-cylinder, substantially as described.

15. The combination with a stop-cylinder having grippers and a plurality of impression-surfaces, said impression-surfaces being spaced apart a distance substantially equal to the gripper-gaps, of a bed having a plurality of printing-surfaces, means whereby the impression-surfaces on the cylinder are alternately brought into printing relation during each printing stroke of the bed, a cylinder having grippers operating to feed sheets to and deliver them from said impression-cylinder, said cylinder being operated from the impression-cylinder, and operating means for the grippers acting to hold them closed after taking a sheet until the sheet has been brought into contact with each printing-surface, substantially as described.

16. The combination with a cylinder, of cylinder-driving means, a gripper-shaft located within the cylinder, a rock-shaft mounted in the cylinder, said shaft having an operating-arm connected thereto which is located outside the cylinder-driving means, connections between the rock-shaft and the gripper-shaft, and means whereby the rock-shaft is caused to operate the grippers, substantially as described.

17. The combination with a cylinder, of cylinder-driving means, a gripper-shaft located within the cylinder, a rock-shaft mounted in the cylinder, said shaft having an operating-arm connected thereto which is located outside the cylinder-driving means, connections between the rock-shaft and the gripper-shaft, means whereby the rock-shaft is caused to operate the grippers, and a spring for closing the grippers, substantially as described.

18. The combination with a cylinder, of cylinder-driving means, a gripper-shaft located within the cylinder, a rock-shaft mounted in the cylinder, said shaft having an operating-arm connected thereto which is located outside the cylinder-driving means, connections between the rock-shaft and the gripper-shaft, means whereby the rock-shaft is caused to operate the grippers, and a spring on the gripper-shaft for closing the grippers, substantially as described.

19. The combination with a cylinder, of a shaft carrying grippers located therein, gears so located as to prevent access to the gripper-shaft, means whereby the gears may be caused to rotate with and independently of the cylinder, devices exterior to the gears and cylinder for causing the operation of the gripper-shaft, and means whereby said devices may be caused to operate said shaft, substantially as described.

20. The combination with a cylinder having hubs, of gears journaled on said hubs, means whereby said gears may be caused to rotate with and independently of the cylinder, a shaft carrying grippers located within the cylinder, a second shaft having one end passing through one of the hubs of the cylinder, and means for operating said shaft, substantially as described.

21. The combination with a cylinder having a hub, of a gear journaled thereon, a locking-lever operating to lock the cylinder and the gear together, and means for operating said lever, substantially as described.

22. The combination with a cylinder having a hub, of a gear journaled thereon, locking-levers mounted on the cylinder, a second lever mounted on the cylinder-shaft, connections between it and the locking-levers, and means for operating the second lever, substantially as described.

23. The combination with a cylinder having a recessed hub, of a gear journaled thereon, a lever mounted on the cylinder-shaft and having a hub extending into the recess of the cylinder, a locking-lever carried by the cylinder and operating to lock the gear and the cylinder together, connections between the locking-lever and the hub of the first-named lever, and means for operating said first-named lever, substantially as described.

24. The combination with a cylinder having a recessed hub, of a gear journaled thereon, a bell-crank lever carried by the cylinder, one of the arms of which engages the gear, a lever having a hub lying in the recess of the cylinder-hub, a loose connection between said hub and the other arm of the bell-crank, and means for operating said lever, substantially as described.

25. The combination with a cylinder having recessed hubs, of a pair of gears journaled thereon, a pair of bell-crank levers carried by the cylinder, one of the arms of each of which engages one of the gears, and the other arm projecting into the recesses in the cylinder-hubs, a two-armed lever mounted on the cylinder-shaft and having a hub extending into the recess in the cylinder-hub, connections between the arms of the bell-crank lever and the hub of the two-armed lever, and a movable cam for operating the two-armed lever, substantially as described.

26. The combination with a cylinder having

a hub, of a driving-gear on the hub, a gripper-shaft lying within the cylinder, a rock-shaft extending through the hub of the cylinder, connections between the rock-shaft and the gripper-shaft, an arm on the end of the rock-shaft, a cam-carrying arm pivoted on the frame, and means for moving this arm into and out of the path of the arm on the rock-shaft, substantially as described.

27. The combination with a cylinder, of a gripper-shaft, means for rocking the shaft to open the grippers, and devices whereby said gripper-operating means are caused to operate on one revolution of the cylinder, to be kept out of operation on the next revolution of the cylinder, and to be operated on the next two successive revolutions of the cylinder, substantially as described.

28. The combination with a gripper-shaft, of a rock-arm, means whereby the motion of this arm is communicated to the gripper-shaft to open the grippers, a spring for closing the grippers, and means whereby the rock-arm is operated on one revolution of the cylinder, kept out of operation on the next revolution of the cylinder, and operated on the next two successive revolutions of the cylinder, substantially as described.

29. The combination with a reciprocating bed having a rack and carrying two printing-surfaces, of a cylinder having a gear meshing with the rack, the cylinder being caused to make a revolution and a half for each printing stroke of the bed, means for locking the gear to and releasing it from the cylinder, sheet receiving and retaining devices on the cylinder, and means for causing said sheet-retaining devices to be operated to take and retain a sheet until it has been brought into contact with each printing-surface, substantially as described.

30. The combination with a reciprocating bed having a rack and carrying two printing-surfaces, of a cylinder having a gear meshing with the rack, the cylinder being caused to make a revolution and a half for each printing stroke of the bed, means for locking the gear to and releasing it from the cylinder, sheet receiving and retaining devices on the cylinder, means for causing said sheet-retaining devices to be operated to take and retain a sheet until it has been brought into contact with each printing-surface, and a cylinder operating to feed sheets to and deliver them from the impression-cylinder, 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,
E. L. SPEIR.