

No. 656,345.

Patented Aug. 21, 1900.

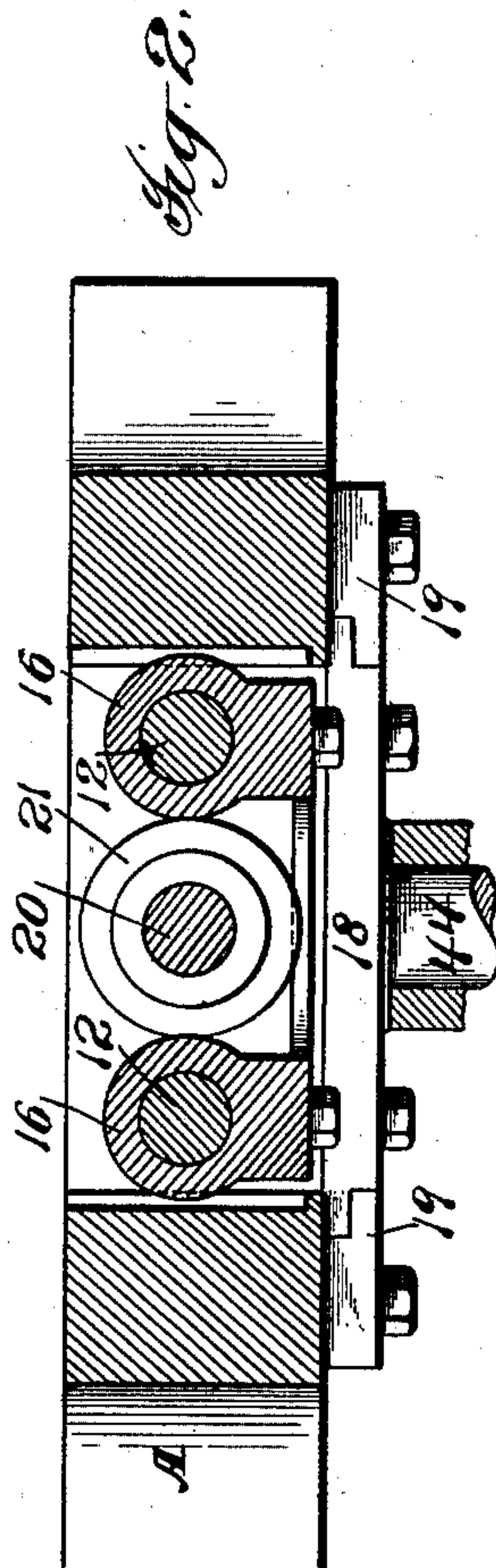
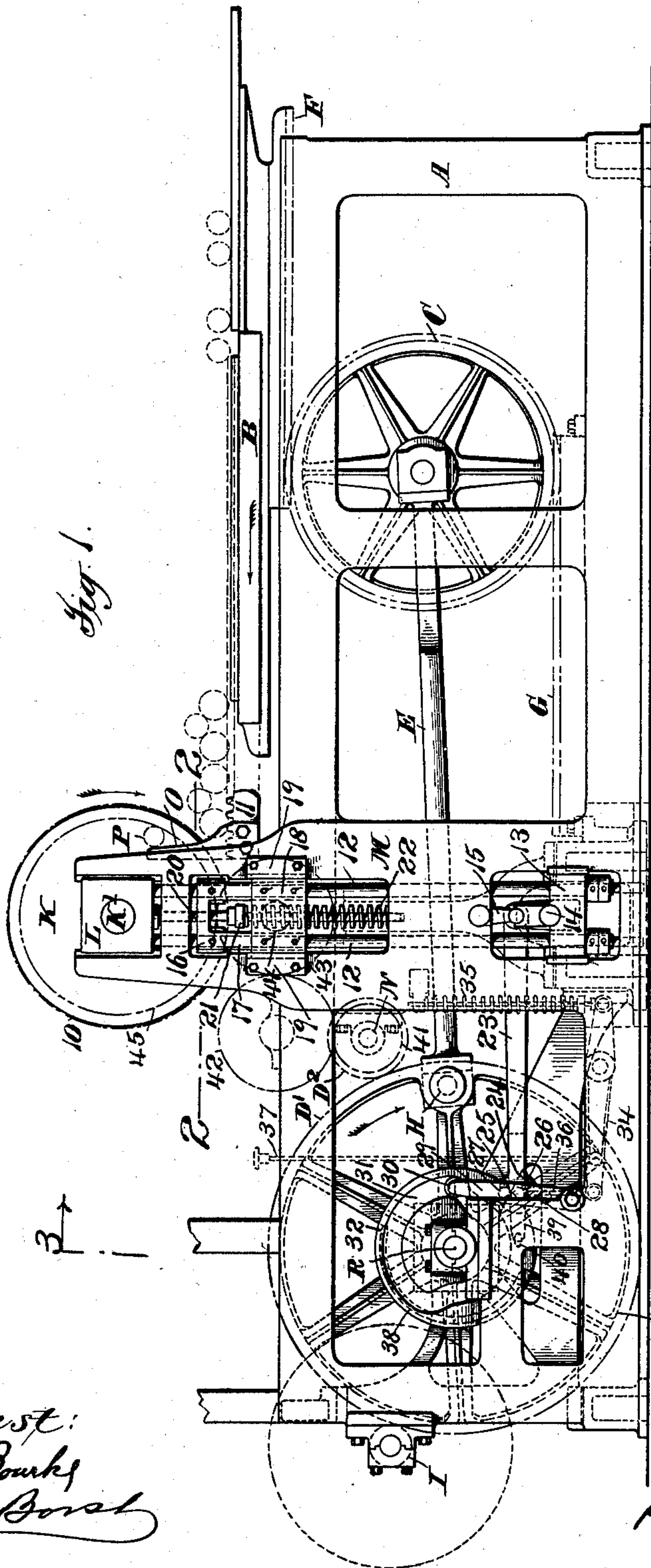
L. C. CROWELL.

BED AND CYLINDER PRINTING MACHINE.

(Application filed Apr. 28, 1898.)

(No Model.)

6 Sheets—Sheet 1.



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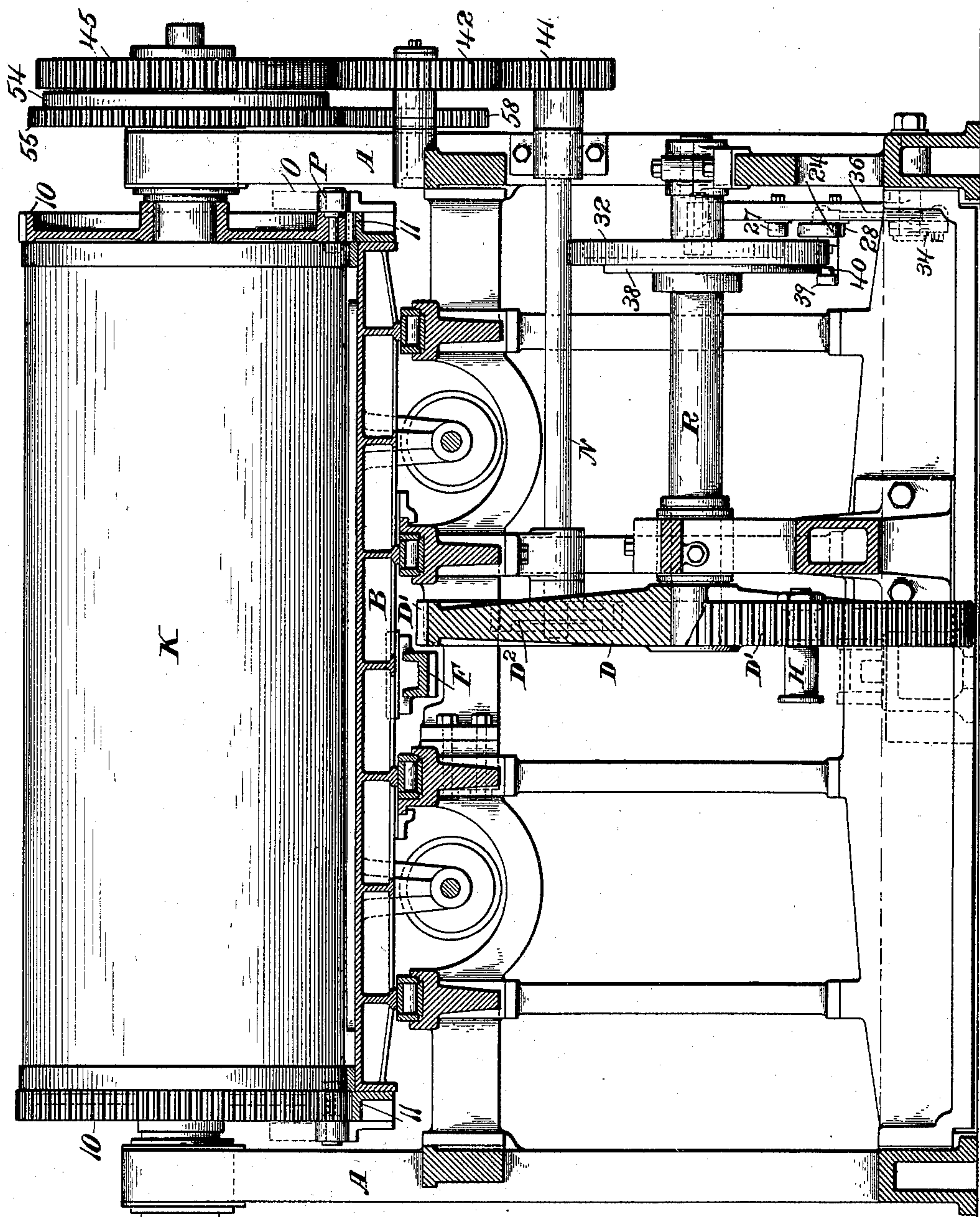
L. C. CROWELL.

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(Application filed Apr. 28, 1898.)

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6 Sheets—Sheet 2.



Attest:  
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Fig. 3.

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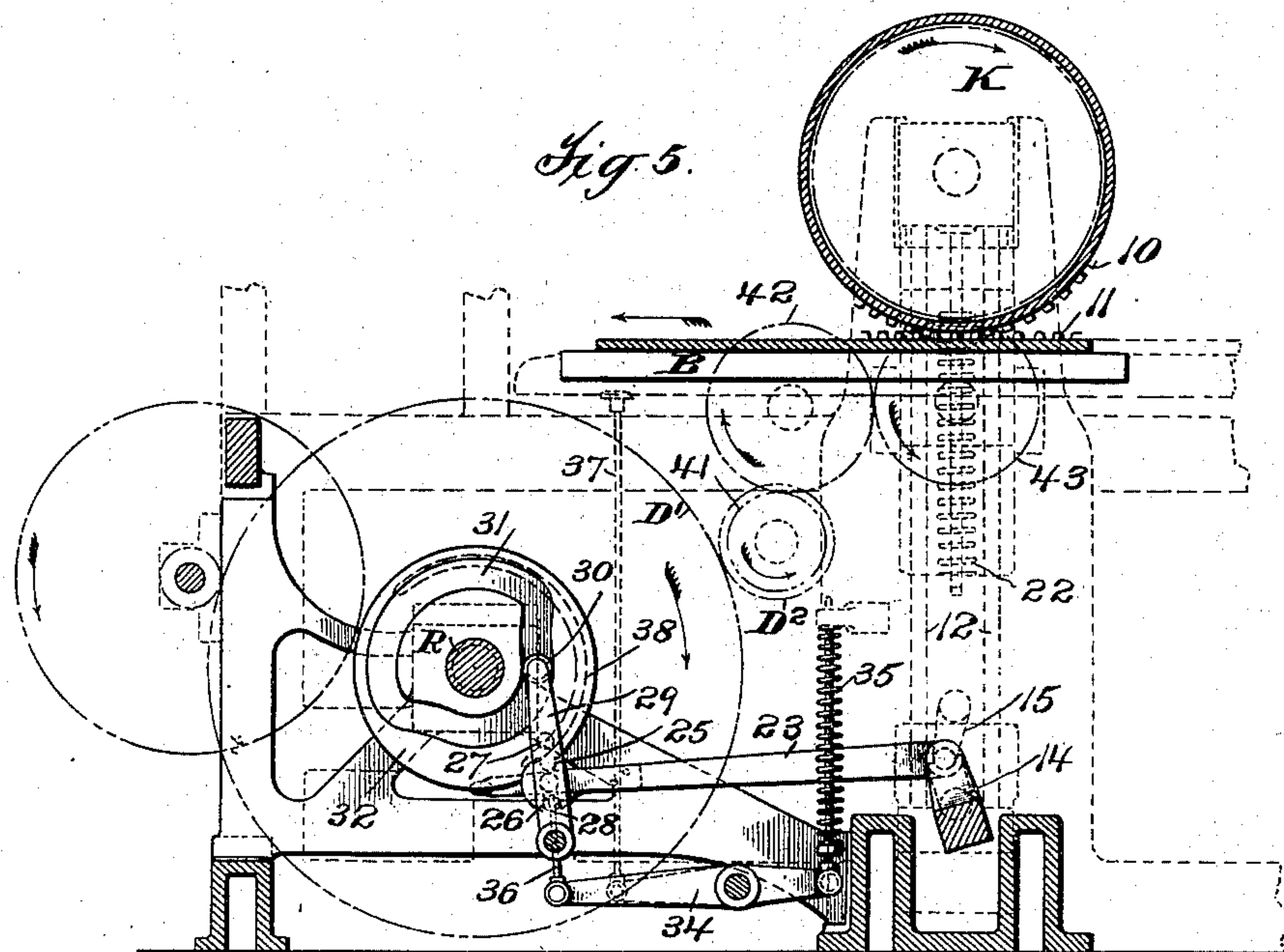
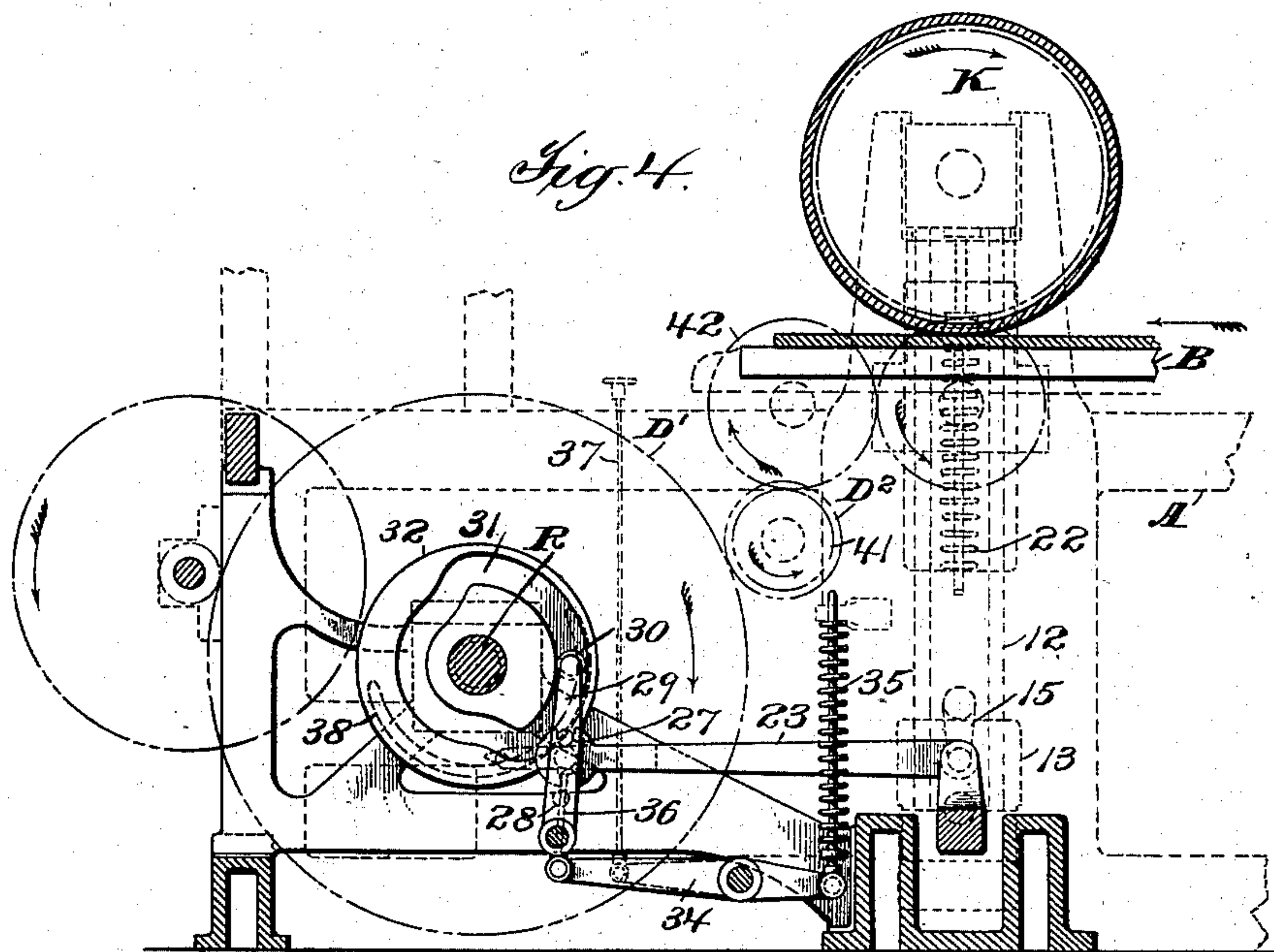
L. C. CROWELL.

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6 Sheets—Sheet 3.



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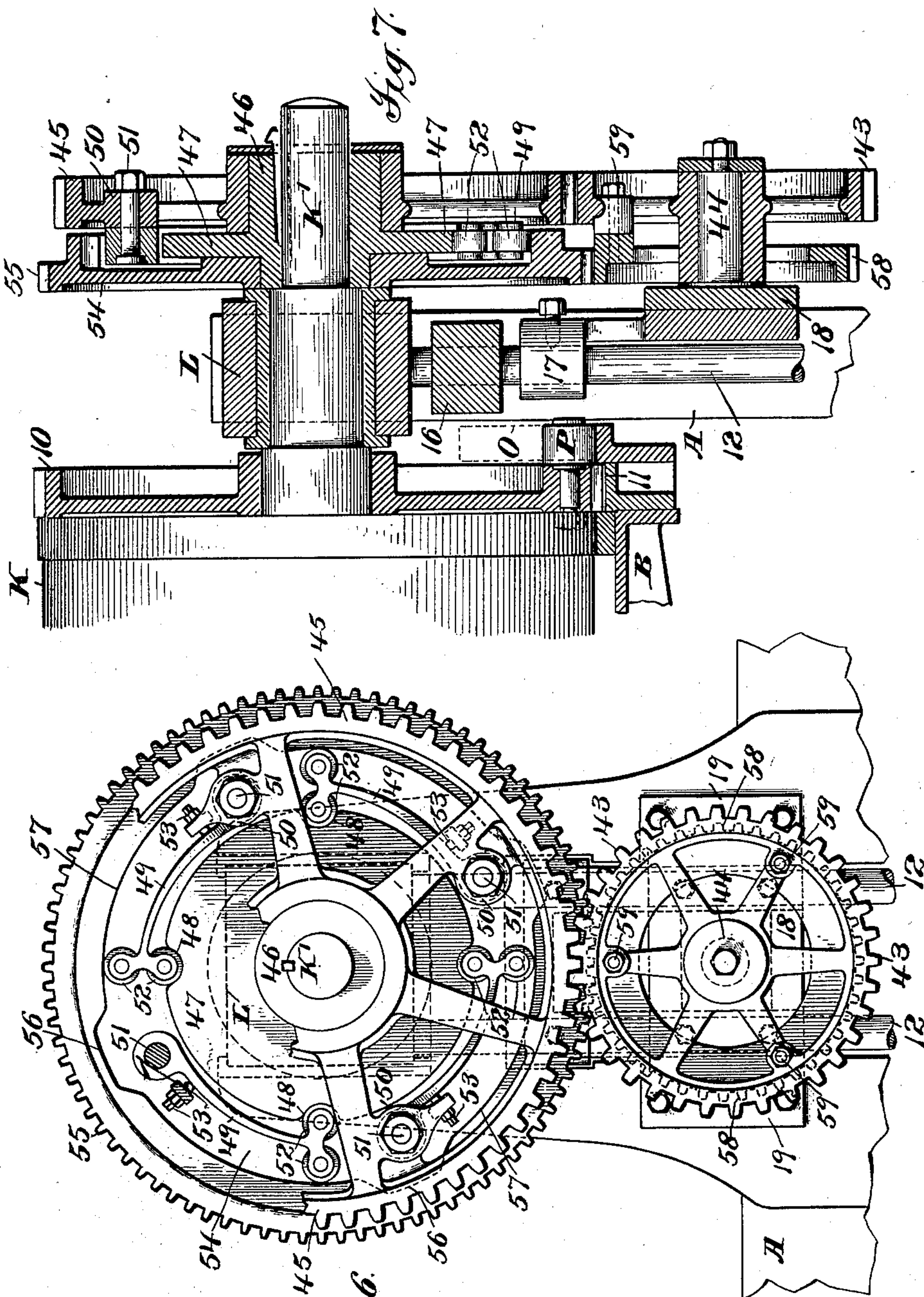
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(No Model.)

6 Sheets—Sheet 4.



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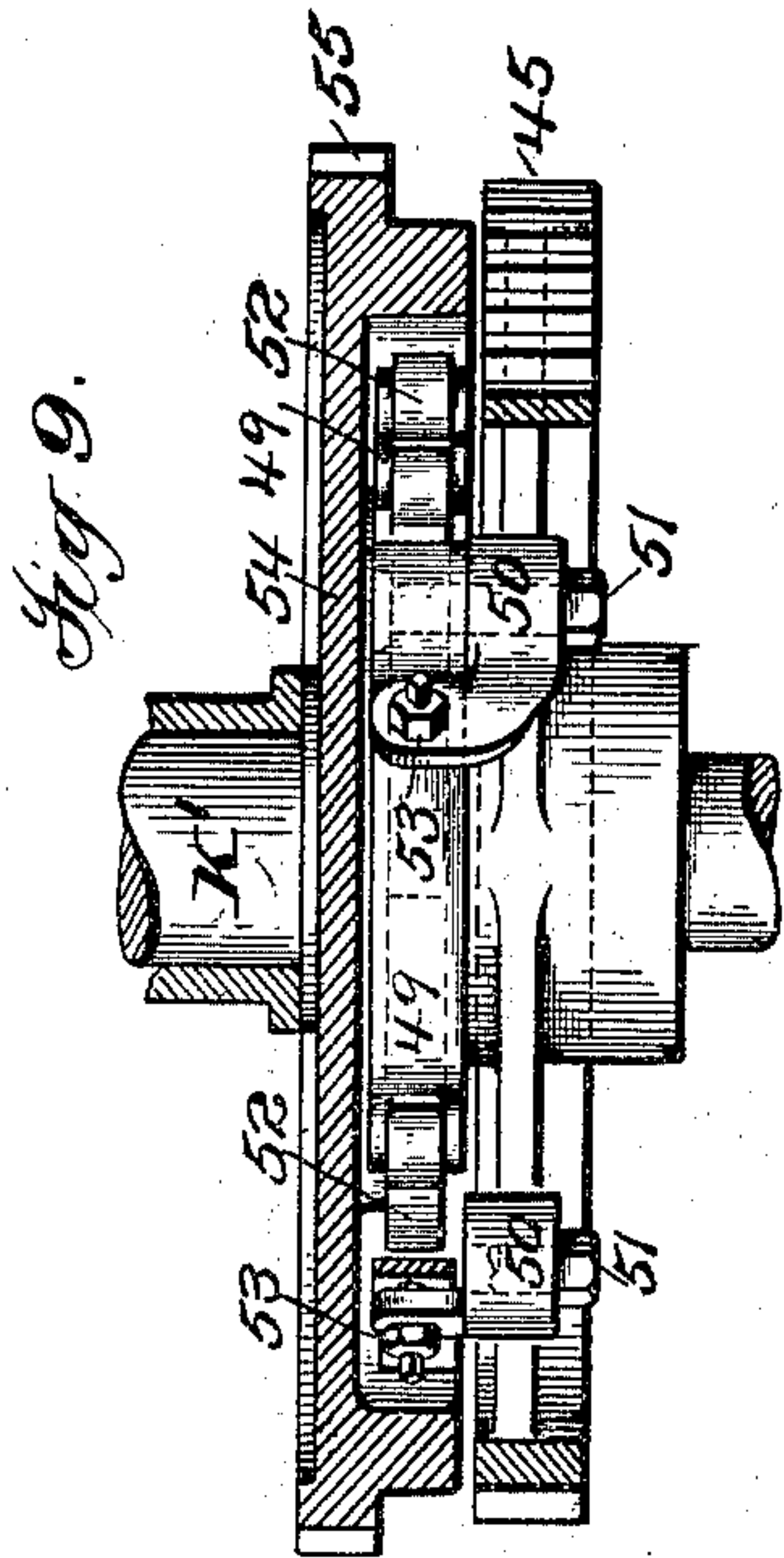
Patented Aug. 21, 1900.

L. C. CROWELL.  
BED AND CYLINDER PRINTING MACHINE.

(No Model.)

(Application filed Apr. 28, 1898.)

6 Sheets—Sheet 5.



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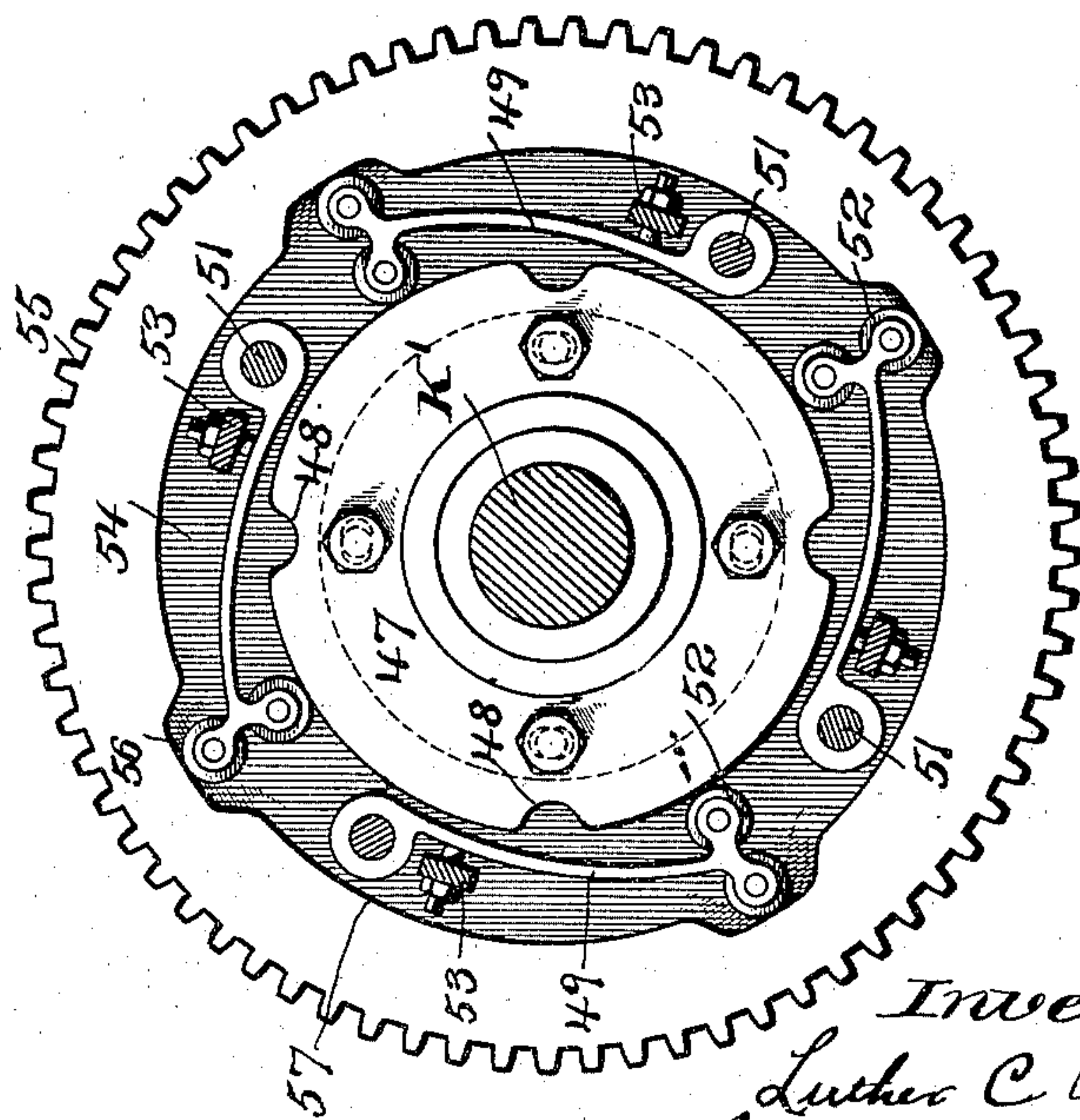
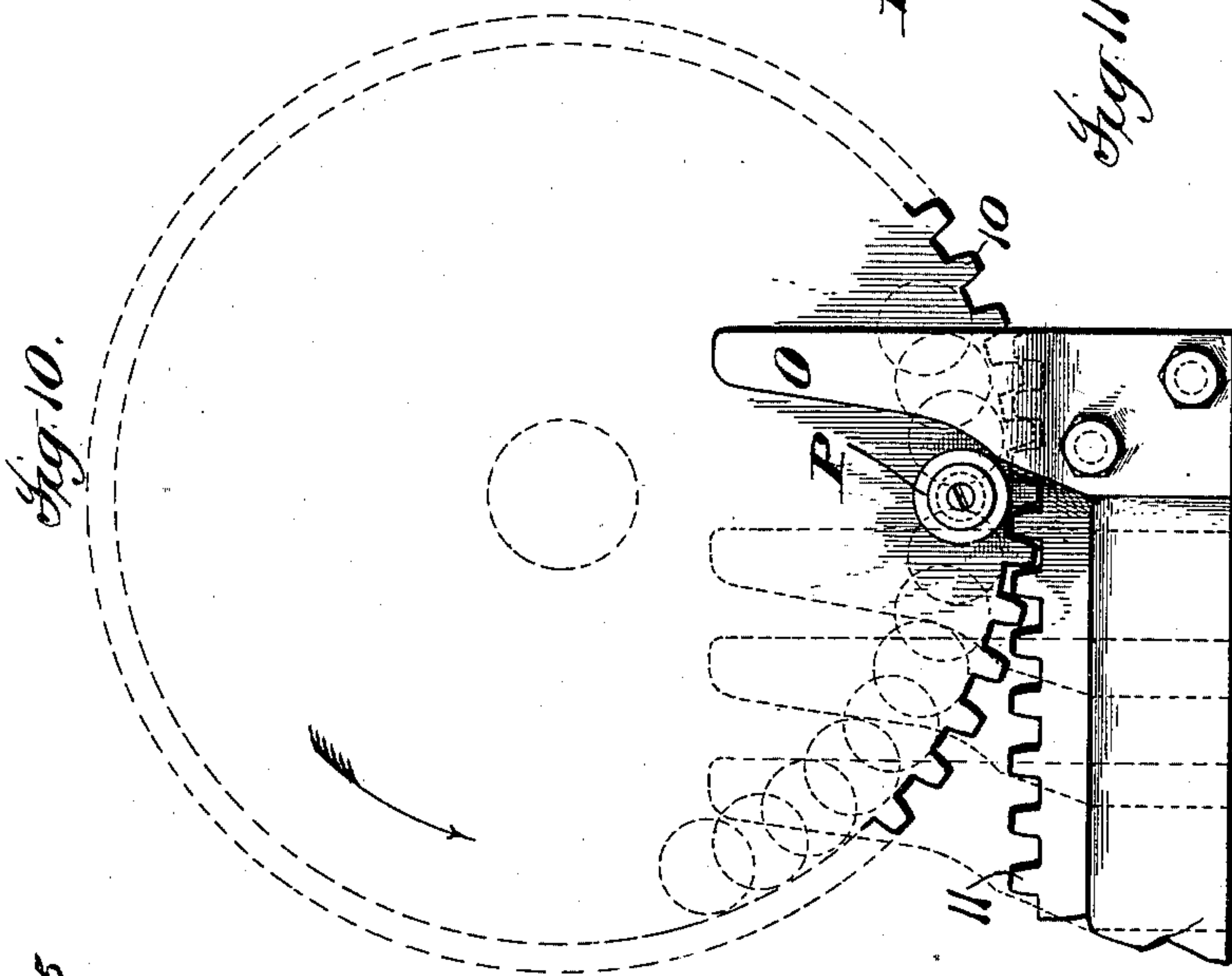
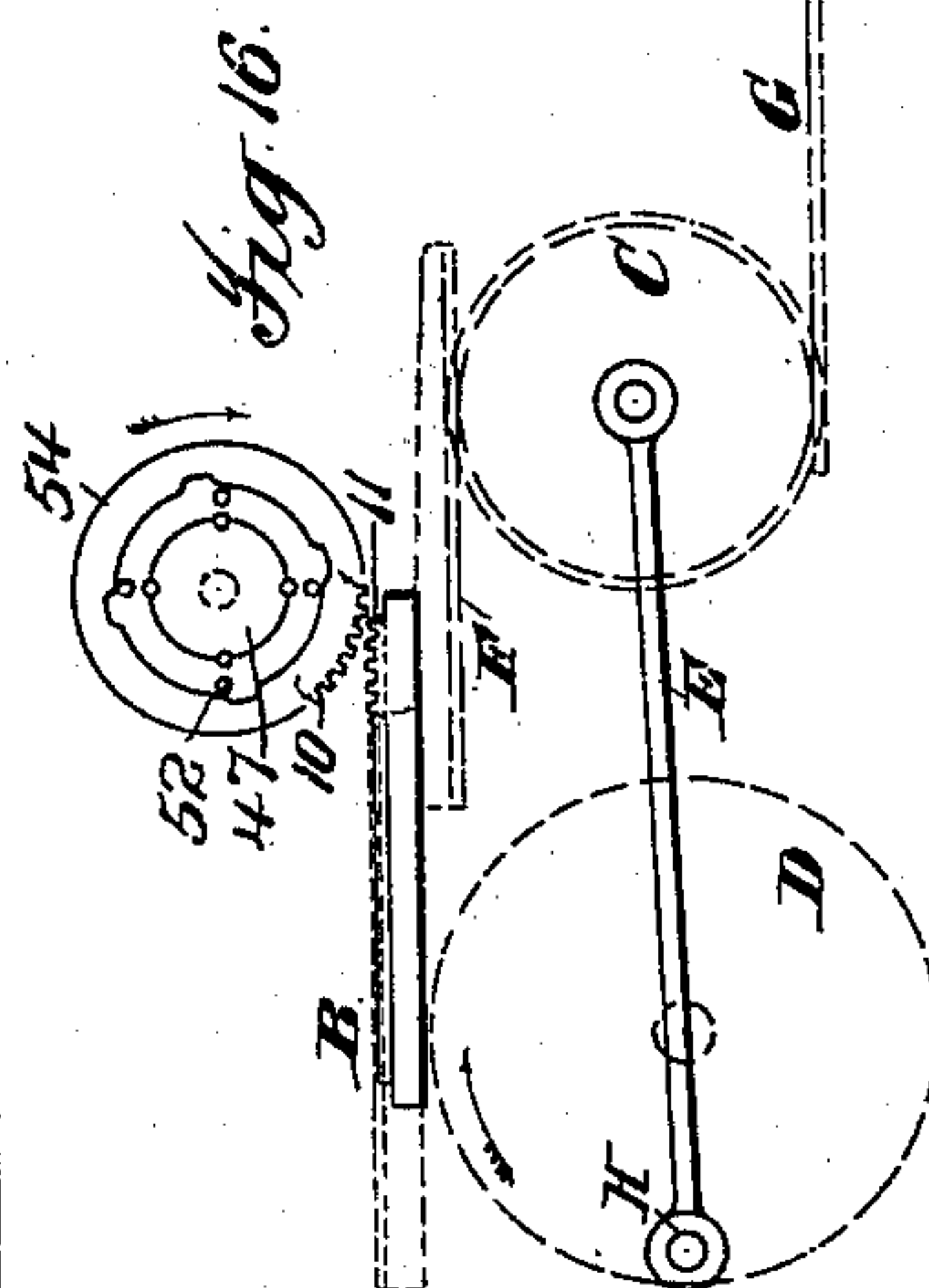
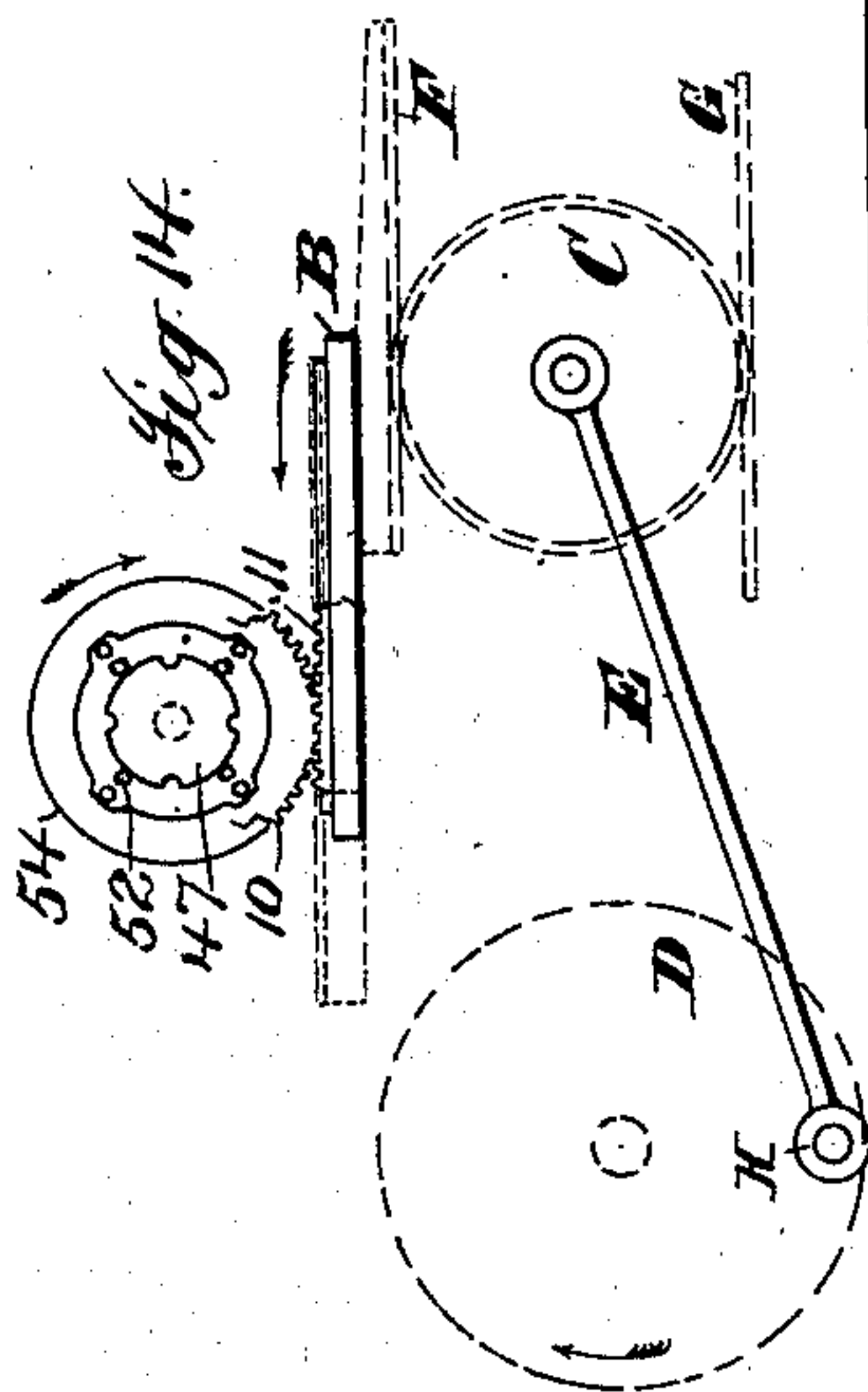
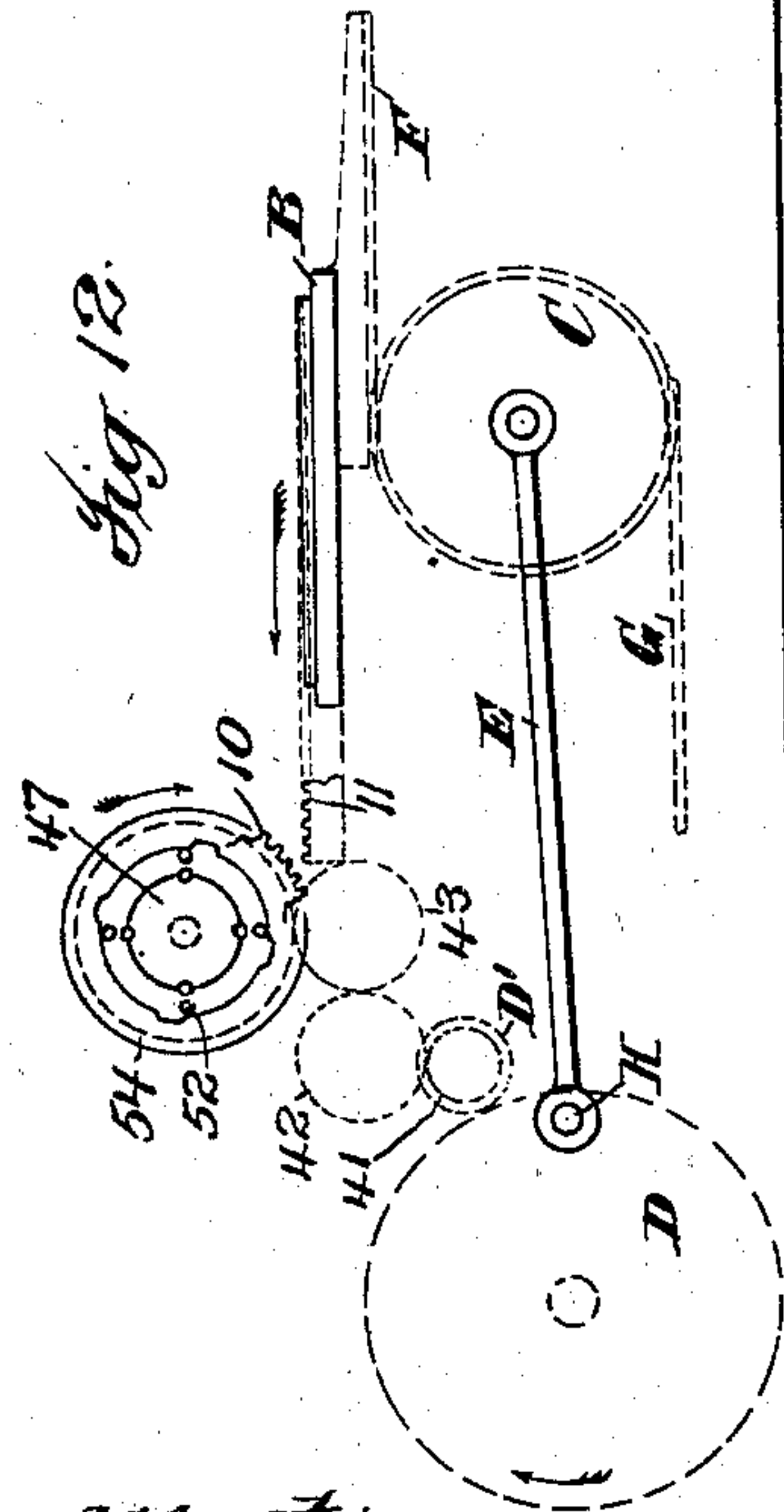
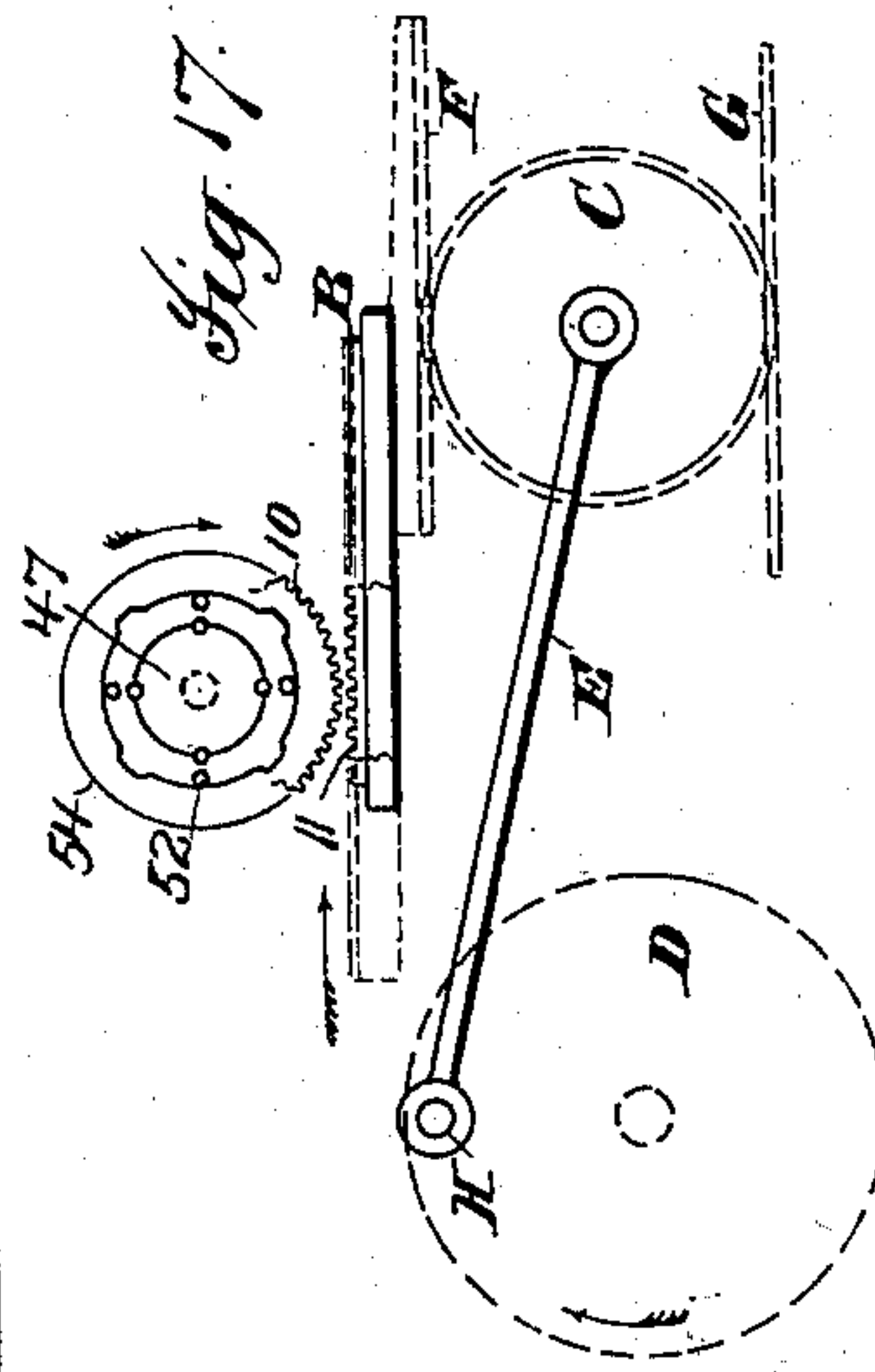
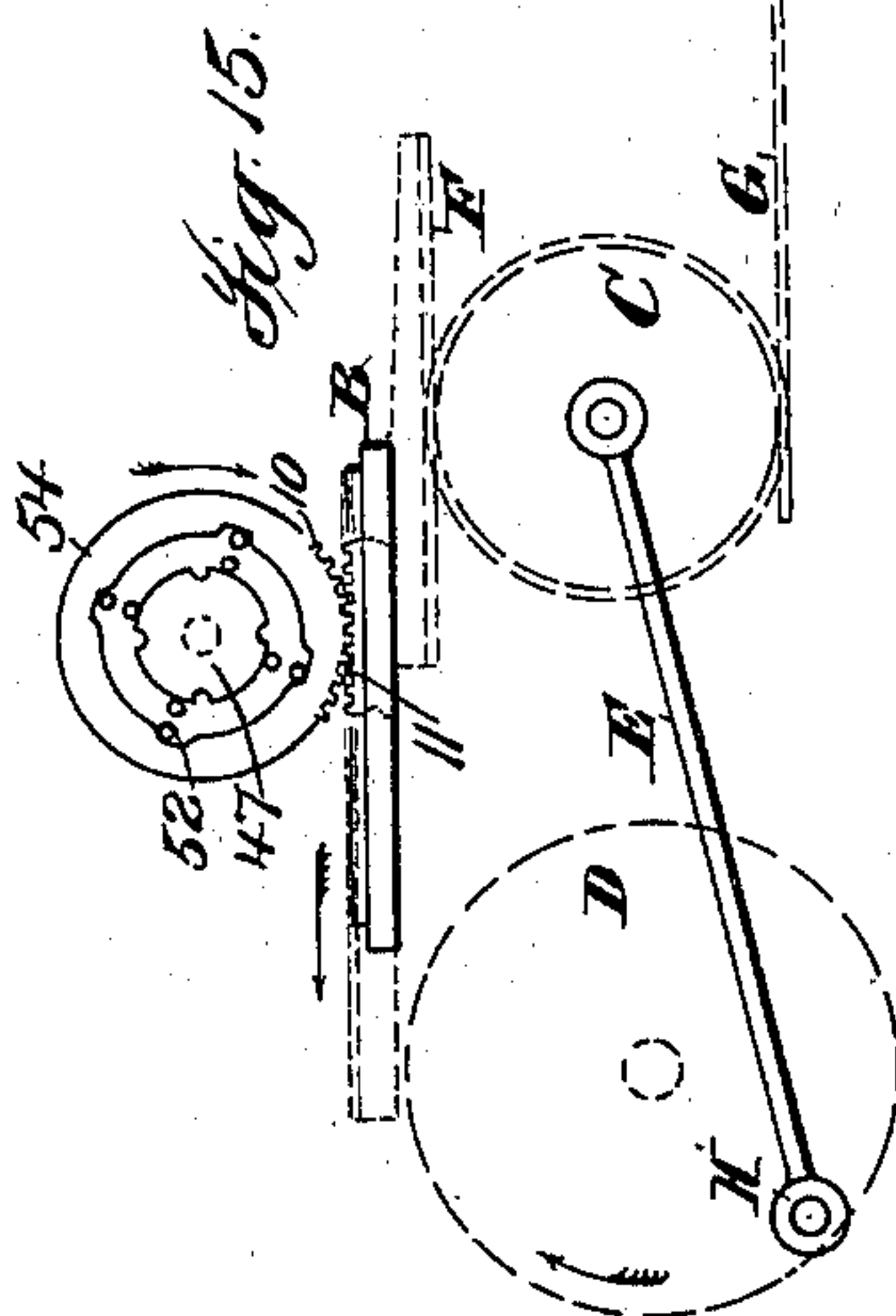
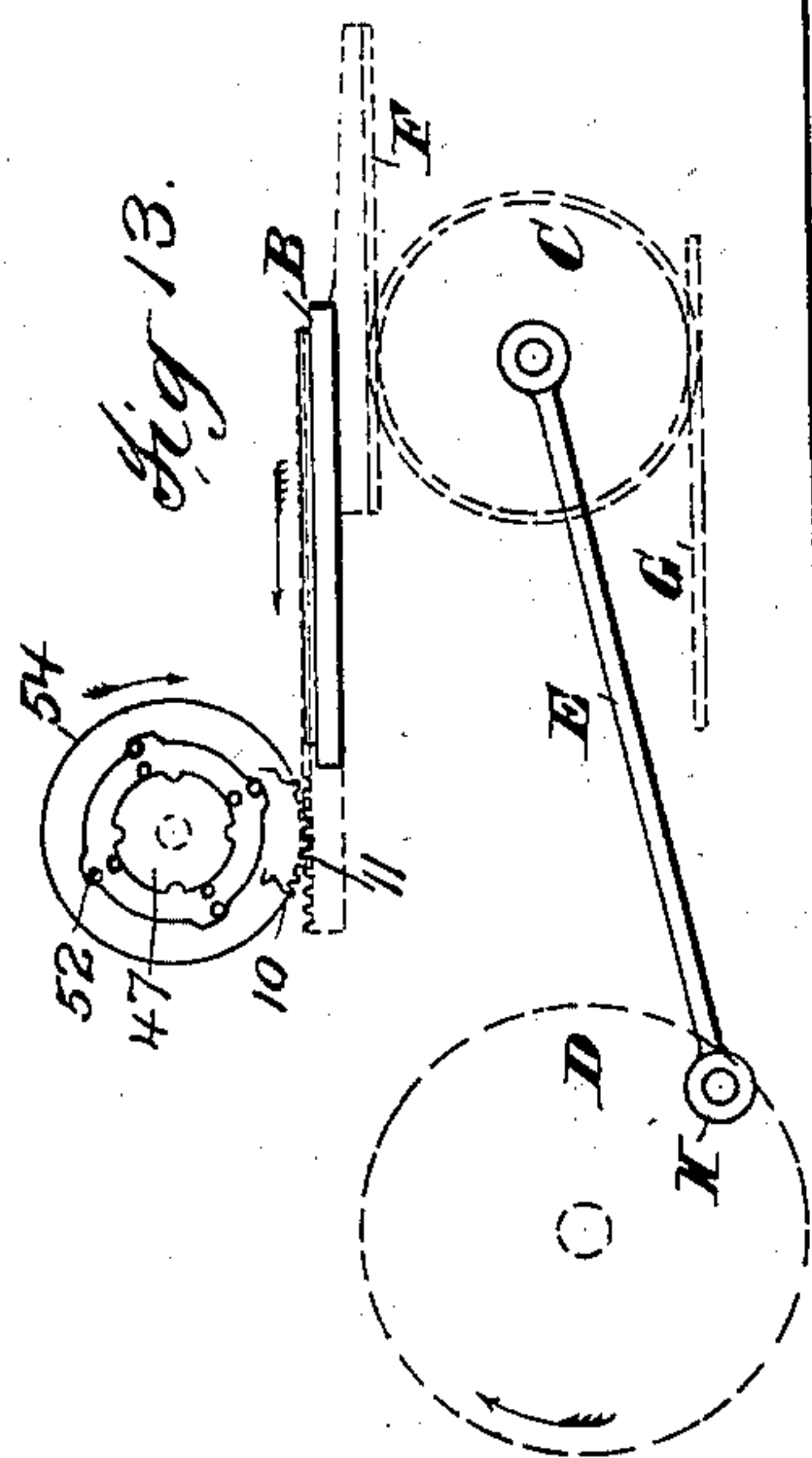


Fig. 8.

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# UNITED STATES PATENT OFFICE.

LUTHER C. CROWELL, OF NEW YORK, N. Y., ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO ROBERT HOE AND CHARLES W. CARPENTER, OF SAME PLACE.

## BED-AND-CYLINDER PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 656,345, dated August 21, 1900.

Application filed April 28, 1898. Serial No. 679,087. (No model.)

*To all whom it may concern:*

Be it known that I, LUTHER C. CROWELL, a citizen of the United States, residing at New York, (Brooklyn,) 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 bed-and-cylinder printing-machines, and more particularly to that class of machines in which the printing is performed by a reciprocating bed operating in connection with a continuously-rotating cylinder. In this class of machines, as is well understood, the cylinder is usually in driving relation with the bed during the printing stroke of the bed or a part thereof and out of such relation during the remainder of the complete reciprocation of the bed, the cylinder at such times being driven by an auxiliary driving mechanism. In such machines, owing to the peculiar movement of the bed, the mechanism which drives the bed should be of such a character as to drive it at a high speed during so much of its stroke as is possible and yet act to slow it down, bring it to a full stop at the point of reverse, start it on its return stroke, and bring it up to its full speed as expeditiously as possible. While various mechanisms have been used to reciprocate the bed, that known as the "mangle-rack" movement has most usually been employed; but with this movement and with others by which the bed is driven at a uniform speed during the greater part of its stroke in both directions and then reversed there is caused an exceedingly-injurious strain and jar of the machine when the machine is run at a high speed. In order to obtain the highest rate of speed and at the same time avoid this strain and jar in reversing, it is desirable to employ the peculiar movement of the crank for driving the bed throughout the whole extent of its movement, since when so driven the bed has a constantly-varying speed—i. e., a speed which constantly increases from a point of reverse up to the middle of its stroke and then constantly de-

creases from that point to the point of reverse. Difficulty has, however, heretofore been experienced in providing a satisfactory construction employing the crank movement for driving the bed throughout the whole extent of its movement. When the crank movement is used for driving the bed throughout the whole extent of its movement, in order to obtain the necessary registry, the speed of the cylinder during the printing operation must exactly coincide with the speed of the bed. To drive a heavy printing-cylinder from the bed at varying speeds causes, however, great strain and wear and tear upon the driving mechanism of the machine. Furthermore, unless the bed and cylinder after having been disengaged to allow the bed to reverse are moving at precisely the same speed when they come into driving relation there is also a resulting shock and jar which is exceedingly injurious to the working parts of the machine, and this shock and jar increases very largely when the machine is operated at high speeds. It has, however, been exceedingly difficult heretofore to cause the bed and cylinder to move at the same speed when engaging if the machine is moving at high speed. It has been necessary, therefore, heretofore to limit the speed of the machines of the type referred to, even when the crank movement is employed to drive the bed throughout the whole extent of its movement, in order to avoid the shock, jar, and wear and tear which, as has been before said, are greatly increased at high speeds.

One object of this invention is to produce a printing-machine of the type referred to in which the bed shall be driven by a crank movement throughout the whole extent of its movement and in which the cylinder while being driven by the bed during the printing stroke, so as to secure the exact synchronism of movement necessary to obtain registry, is disengaged from the bed practically at the completion of the printing stroke, and is driven thereafter by an auxiliary mechanism which maintains the movement of the cylinder at precisely that speed which it had when it was disengaged from the bed. When the bed after having accomplished its reverse



and immediately or very shortly before it reaches that point at which the printing is again to begin is moving at precisely the speed which it had when it was disengaged from the cylinder, the cylinder is brought into engagement with the bed, and since the cylinder has maintained a constant speed during the period of disengagement the two will be traveling at the moment of engagement at exactly the same speed. There will therefore be no resulting shock or jar from such engagement. It will be seen, further, that during the time when the cylinder is in engagement with the bed the variations in speed due to the crank movement will not be sufficient to cause any injurious strain and wear, because this occurs at the time when the movement is nearly constant. Consequently machines embodying my improvement may be driven at a speed which has been heretofore practically found to be impossible.

A further object of the invention is to produce in the type of machines heretofore referred to—namely, machines in which the cylinder is raised and lowered to effect its engagement with and disengagement from the bed—an improved means for controlling the amount which the cylinder is lowered, and thereby allowing the cylinder to be “off impression” without disengaging it from the bed.

A further object of the invention is to produce an improved means by which in machines of the type heretofore referred to any “lag” in the movement of the bed caused by a failure to adjust the parts of the machine with sufficient exactness or due to any spring of any of the operating parts whereby a slight overrunning of the bed may be produced is corrected.

With these objects in view my invention consists in certain mechanical devices and in certain parts, improvements, and combinations thereof, which will be particularly described in the following specification and the novel features of which will be pointed out in the claims hereto appended.

This invention is particularly adapted for use in connection with machines of the two-revolution type, in which during the printing-stroke the cylinder is driven from the bed by a rack on the bed intermeshing with a gear on the cylinder, and the engagement and disengagement of the cylinder and the bed are effected by raising and lowering the cylinder. The invention is, however, applicable to all machines in which a continuously-rotating cylinder coöperates with a reciprocating bed.

In the accompanying drawings, which constitute a part of this specification, and in which like reference characters indicate the same parts, Figure 1 is a side view of a bed-and-cylinder machine embodying my invention. Fig. 2 is a sectional detail taken on the line 2 2 of Fig. 1. Fig. 3 is a transverse vertical section of the machine shown in Fig. 1, taken on the line 3 3, certain of the operating

parts being removed. Fig. 4 is a sectional view of one end of the machine, showing the throw-off mechanism in the position which it occupies when the bed and cylinder are in engagement. Fig. 5 is a view similar to Fig. 4, but showing the throw-off mechanism and the cylinder in the position they assume when the cylinder is off impression, but is engaged by the operating parts. Fig. 6 is an end view of the auxiliary mechanism for driving the cylinder when it is disconnected from the bed. Fig. 7 is a vertical central section of the devices shown in Fig. 6. Figs. 8 and 9 are a face and sectional view, respectively, of a certain part of the auxiliary driving mechanism, the spring-pawls being shown as disengaged from the cylinder. Fig. 10 is a side view, and Fig. 11 is an end view, of the device used when necessary to correct any lag or overrunning of the bed. Figs. 12 to 17, inclusive, are diagrams indicating the relative positions of the crank-driving mechanism, the bed, the cylinder, and devices for connecting the cylinder to the auxiliary driving mechanism at various times during a complete reciprocation of the bed.

In the machine shown in Fig. 1, which illustrates the practical application of my invention, A indicates the frame of the machine, B the bed, C the railroad-gear, D the crank-wheel, E the rod connecting the crank-stud H on the crank-wheel D with the railroad-gear, F the rack on the bed, G the rack on the frame, with which two racks the railroad-gear engages, all of which parts are common and well known. The crank-wheel D is driven by a pinion I, the belt-pulley for the said pinion being indicated by a dotted line in Figs. 1, 4, and 5. The printing-cylinder K is journaled in the usual boxes L, and is provided with a gear 10, which meshes with a rack 11 on the bed. The boxes L are held to slide in ways, as is usual, in the upper ends of standards M, rising from the frame A. Depending from the sliding boxes L are a pair of rods 12, the rods being connected at their lower ends by cross-bars 13, which also slide in ways on the standards. These cross-bars 13 receive the lower members 14 of a pair of toggles, the upper members 15 of which are journaled in the standards. Near the upper ends of the rods 12 they are embraced by collars 16, from which depend extensions 17. A slide 18 is bolted or otherwise secured to the extension 17, which slide moves in guides 19, secured to the standard. A rod 20 passes through a perforation in the standard and through the cross-piece connecting the collars 16, and upon this rod is mounted a collar 21, between which and a socket in the standard is held a spring 22. It is obvious that as the toggle 14 15 is made and broken the printing-cylinder will be raised and lowered by the mechanism so far described. The toggle 14 15 is made and broken by means of a rod 23, having on its inner end a gab-hook 24, provided with an upper recess



25 and a lower recess 26. These recesses are intended to engage, respectively, upper and lower pins 27 and 28, carried on a rocking lever 29. This lever is pivoted on the frame of the machine and carries on its end a bowl 30, which engages a cam-groove 31 in a cam-wheel 32, mounted on the shaft R of the crank-wheel D. As the cam-wheel 32 is revolved, it is obvious that the toggle 14 15 will be made and broken once for each revolution of the cam-wheel through the agency of the pivoted lever and gab-hook before referred to, and consequently that the cylinder will be given one complete vertical reciprocation during this time.

Pivoted upon the frame of the machine is a lever 34, one end of which is controlled by a spring 35 in an obvious manner and the other end of which is connected by a link 36 to the gab-hook 24, before referred to. Rising from the lever 34 is a push-rod 37. (Shown in dotted lines in Figs. 1, 4, and 5.) This push-rod has its end located at a point which can be conveniently reached by the pressman or feeder. It is obvious that through the medium of the push-rod and spring before referred to the gab-hook may be moved so that its upper and lower recesses 25 26 may be made to engage either the pin 27 or the pin 28 on the rocking lever 29, and inasmuch as the pin 28 is nearer the center of movement of this lever than the pin 27 it is obvious that when the recess 26 engages the pin 27 the movement of the gab-hook, and consequently the straightening movement of the toggle to which the gab-hook is connected, will be less than when the recess 25 is engaging the pin 27. When, therefore, through failure to feed a sheet to be printed or other reason it is desired to have the cylinder off impression and yet kept in engagement with the rack on the bed, so that it may move with and preserve its proper relation to the bed, the pressman or feeder places his foot upon the rod 37 and through the agency of the connections described throws the gab-hook down, so that its recess 26 engages the pin 28, by which the downward movement of the cylinder is limited and printing contact with the form prevented. When the cylinder is to receive its full reciprocation in a downward direction, the gab-hook is kept in engagement with the pin 27.

Mounted on the cam-wheel 32, but on the side thereof opposite to the cam-groove 31, is a cam 38. (Shown in dotted lines in Figs. 4 and 5.) The office of this cam is to control the movement of the gab-hook, so as to permit it to be thrown from one pin to the other only at certain times in the rotation of the cam-wheel 32, and consequently the crank-wheel D, and to maintain it after being thrown in its engagement with either of the pins. The gab-hook 24 (see Fig. 3) has extending from its side a short arm 39, which has mounted therein an inwardly-extending cam projection 40. This cam projection 40 engages the

cam 38, traveling on the outer side of the cam when the gab-hook is held in engagement with the pin 28 and on the inner side of the cam when the gab-hook is held in engagement with the pin 27. The open part of the cam 38 comes opposite the cam projection 40 only when in the operation of the machine the cylinder is fully elevated, and it is only, therefore, when the cylinder is in this position and the toggle fully broken that the gab-hook can be shifted from one of the pins 27 28 to the other. It will be obvious, therefore, that the cylinder will always be raised to the full extent of its reciprocation because the gab-hook and connecting parts always act to fully break the toggle; but the amount which the cylinder is lowered will depend upon whether or not the gab-hook is engaging the pin 27 or the pin 28.

The gear 11 on the bed is made of such a length that the cylinder-gear 10 does not come into mesh therewith as it is lowered by the mechanism described, but after the cylinder reaches the position which it occupies when it is meshing with the rack the reciprocating movement of the bed causes its rack 11 to run into mesh with the gear 10.

Suitably mounted in the frame is a counter-shaft F. This counter-shaft has a pinion D<sup>2</sup> upon its inner end which meshes with the gear D' on the crank-wheel D, and on its outer end a pinion 41, this pinion being the first of a train of auxiliary gearing the function of which is to operate the cylinder when it is not operated by the rack on the bed. The pinion 41 meshes with an intermediate 42, and this intermediate meshes in turn with a gear 43, which is journaled on a stud 44, mounted in the slide 18. This gear 43, is constantly in mesh with a gear 45, which is loosely mounted on a boss or hub 46, extending from a disk 47, which is keyed to the cylinder-shaft K'. It is obvious that the gear 45 will revolve continuously and that its speed will be constant, inasmuch as it is connected through the train of gearing 43, 42, and 41 to the gearing on the circumference of the constantly-revolving crank-wheel D, which of course moves at a constant speed. The disk 47 has a series of notches 48 in its periphery, which in the machine shown are four in number. The gear 45 has pivoted to it a series of spring pawl-arms 49, these arms being secured to bosses 50 by bolts 51. The outer end of each of these pawl-arms is preferably provided with a pair of friction-wheels 52, which friction-wheels at certain times in the revolution of the cylinder engage with the notches 48 in the disk 47, before referred to. The throw of these pawl-arms is controlled by means of adjustable stops 53, which are also mounted on the gear 45. Also loosely mounted on the hub 46, but on the side of the disk 47 opposite to that on which the gear 45 is mounted, is a disk 54. This disk has a gear 55 on its circumference and is provided with high parts 56 and low parts 57. The gear 55 of this disk is in



mesh with a gear 58, which gear is herein shown as formed on the circumference of an annulus which is bolted or otherwise secured to the gear 43 by the bolts 59. This gear 58 is, as will be observed from the drawings, somewhat smaller in circumference than the gear 43, and the gear 55, with which it meshes on the disk 54, is somewhat larger than the gear 45. It being remembered that the gear 43 is constantly revolving because of its connection through the train of gearing before referred to with the gear D' on the crank-wheel D, it will be understood that the gear 58 is also constantly rotating and is rotating the disk 54 by means of the gear 55. Consequently the gear 45, carrying the spring-pawl arms before referred to, the disk 54, having the high and low parts 56 and 57, and the notched disk 47 are all constantly rotating, but are rotating at different speeds.

It being remembered that the bed is being constantly reciprocated at varying speeds and that the printing-cylinder is in mesh therewith at various times during the printing stroke and that the cylinder is therefore during that part of its revolution in which it is in mesh with the rack on the bed moving with a varying speed, the operation of the construction hereinbefore described will be clear. Just at the time when the cylinder is about to be disengaged from the rack on the bed through the breaking of the toggles and the action of the springs before described, which is as soon after the completion of the printing operation as the speed of the bed and the speed of the constant-speed mechanism coincide, the gear or pawl carrier 45, with its attached spring-arms 49, is in such a position with reference to the notched disk 47, which is fast on the cylinder-shaft, that the friction-wheels 52 will engage the notches 48 in the disk. At the time when the friction-wheels on the spring-arms have fully engaged the notches in the disks or very soon thereafter the cylinder becomes completely disengaged from the rack on the bed. The cylinder is therefore now driven directly from the gear D' on the crank-wheel D through the medium of the train of gearing heretofore referred to and the gear 45, which, as before-said, is locked to the notched disk 47 by the engagement of the spring pawl-arms 49. At the time when the cylinder was released from the rack on the bed and taken by the gear 45 it will be understood that the speed of the bed and cylinder exactly corresponded to that of the gear or pawl carrier 45, and since the carrier 45 always rotates at a constant speed the cylinder will continue to run at precisely the speed which it had when it was released by the bed. At the time when the spring pawl-arms engage the notched disk 47 the locking-disk 54, which, it will be remembered, is running slower than the carrier 45, has reached that phase in its movement where one of its low parts comes in contact with the upper one of the pair of friction-wheels 52.

It acts, therefore, to snugly hold and lock the lower wheel 52 in its engagement with the notched disk, thereby preventing any accidental displacement.

The operation of these various parts will be well understood from an inspection of the diagrammatic views illustrated in Figs. 12 to 17, inclusive. In the diagram illustrated in Fig. 12 the crank-stud H is shown on the dead-center, and the bed is consequently at the point of reverse. At this time, therefore, the bed-rack and cylinder-gear are disengaged and the cylinder is being driven by the carrier 45 and its spring pawl-arms, motion being derived from the gear D' through the train of gearing before referred to. At this time also the locking-disk 54 is in such a position as to lock the friction-wheels on the spring-arms into engagement with the notches on the disk 47. After the crank has traveled over about one-eighth of a revolution (see Fig. 13) the bed has reached the point where its rack 11 has engaged the gear 10 on the cylinder. At this time the speeds of the bed and the cylinder are substantially equal and the cylinder is beginning to be driven by the bed. The speed of the disk 47 now begins to increase by reason of the increasing speed of the bed, so that it is traveling faster than the carrier 45, carrying the spring pawl-arms, and the friction-wheels on the arms have slipped out of the notches or, more accurately speaking, the notches have slipped out from under the wheels, the locking-disk 54 at this time having come into such a position that one of its high parts coincides with the wheel, and therefore allows the necessary upward movement of the spring-arm. During about the next two-eighths of the revolution of the crank the cylinder is driven wholly by the bed. During this time, however, the speed of the bed while it is first slightly increasing and then slightly diminishing is more nearly constant than at any other time during its reciprocation, and it is therefore enabled to operate the cylinder with less strain upon the working parts than at any other time in its reciprocation. Referring to Fig. 15, at which time the crank-stud is about to complete the last one-eighth of its half-revolution, it will be seen that the locking-disk 54 and pawl-carrier 45 are just nearing the position in which the friction-wheels on the pawl-arms will ride into the notches in the disk 47, at which time the speed of the bed coincides with the speed of the cylinder when driven by its auxiliary driving mechanism. As soon as this movement is effected the gear 10 of the cylinder and rack 11 of the bed are disengaged by the rack 11 running out of engagement with the bed in the preferred construction, and the rotation of the cylinder is then controlled by the train of gearing meshing with the gear on the crank-wheel. The bed passes on to the point of reverse, as shown in Fig. 16, the cylinder remaining under the control of the gears, and inasmuch as the cyl-



inder remains raised and therefore out of mesh with the gear 11, it will be rotated by the train of gearing during the entire return stroke of the bed and also during the forward stroke until the bed is about to again run into printing relation with the cylinder, at which time the cylinder is lowered and is again taken by the rack, the spring-pawls at that time riding out of the notches in the disk 47 in the manner hereinbefore described. It will of course be understood that the gears which operate the locking-disk and the pawl-carrying gear are so proportioned as to bring these parts in proper position to allow the operations heretofore described to be effected. In a two-revolution press of the character and proportioned and constructed as herein described, and in which one revolution of the wheel carrying the crank-stud causes two revolutions of the cylinder and one complete reciprocation of the bed, the pawl-carrying wheel is designed to make one and three-quarter revolutions while the cylinder makes two revolutions, and the locking-disk makes one and one-half revolutions while the cylinder makes two revolutions. From the point where the rack on the bed engages the cylinder to the point where it releases the cylinder the speed of the cylinder will be such compared with the constant movement in the gear-train before referred to that the cylinder will carry the notched disk a quarter-revolution ahead of the pawl-carrying wheel. At the same time the locking-disk is retarded a distance equal to a quarter-revolution for each complete two revolutions of the cylinder. It is to be understood, however, that these proportions, while desirable, are not necessary, and modifications may be made therein, such modifications having proper relation to the size of the cylinder and the length of the printing stroke. So, also, the locking-disk might be arranged to run at a greater speed than the pawl-carrying disk, if desired. It will also be understood that the notched disk, pawls, and related parts form a locking device or clutch which when it locks the cylinder to the gearing before described is absolutely positive in its operation and maintains the cylinder at precisely the speed of the gearing, and when the point in the operation of the machine is reached where it is desired to increase the speed of the cylinder the unclutching operation is effected by the increased speed of the cylinder.

It may occur by reason of the fact that the adjustment of the various parts is not made with sufficient fineness, or from a wear in the operating gears, or from a variation in the operation of the cushioning devices, or from an unavoidable spring in the operating parts, that the bed in its reciprocation will slightly overrun, and therefore will lag on its return stroke, and since the movement of the cylinder, as has been before said, is constant the rack on the bed will fail to exactly mesh with the cylinder-gear. A horn-cam O is therefore

attached to the bed, which coöperates with a bowl P, attached to the cylinder. This horn-cam and bowl are so located with relation to each other that the bowl will engage the cam just before the rack on the bed meets the gear on the cylinder, and in case there is any lag in the bed from any of the causes heretofore referred to or from any other cause, so that the gear and rack fail to mesh properly, the cam and bowl will act to bring the parts into such relation to each other as to effect the proper mesh. It has been found in practice, however, that the horn-cam and bowl referred to do little or no work when the machine is running at the speed which it is designed to have during the printing operation. In other words, when the parts of the machine are adjusted so as to run at a certain speed this adjustment can usually be made sufficiently fine so that the reciprocation of the bed will bring its rack at the proper time into exact mesh with the cylinder-gear. It is only when the speed for which the machine is adjusted is either increased or diminished that the lag referred to occurs, and at such times unless the horn-cam be provided the gear and rack come into mesh with a slight snap. The horn-cam and its bowl, therefore, are not necessary to the operation of the device, although they constitute a desirable adjunct.

Various modifications of this device may be made without departing from the scope of the invention. For instance, the number of spring-pawls and coöperating notches on the disk may be varied. Such modifications will depend, however, as has been before indicated, on the size of the cylinder and the length of the bed or the printing contact thereof. Furthermore, the locking-disk, although desirable to insure a perfect grip of the spring-pawls on the notched disk and to avoid any accidental slip between these two parts, is not necessary, and it may be omitted. It is also not necessary that the devices for locking the notched disk to the constant-speed mechanism shall be spring-pawls. Rigid arms may be used instead of spring-pawls, and various other forms of locking devices may be used, and also it is to be understood that when spring-pawls are used it is not necessary that they be in the form of spring-arms; but rigid arms controlled by suitably-disposed springs may be used. While also the preferred form of clutch or locking mechanism by which the cylinder is locked to the auxiliary gearing is such as heretofore described—i. e., one in which the unclutching operation is effected by a slip caused by the increased speed of the cylinder, and such a clutch is one of the features of the invention specifically considered—yet it is to be understood that the invention in its broader form is not limited to this or any specific form of clutch. It is also to be understood that this invention is not limited in its application to printing machinery. While it is adapted for such a use, and particularly in connection with



the type of printing-machine described, it is of much broader application and can be used in any machine wherein it is desired to control the operation of moving parts which have a relation to each other similar to that of the bed and cylinder of a printing-machine.

Various modifications other than those heretofore specified may be made without departing from the spirit and scope of this invention, the essence of which is to provide in a machine the moving parts of which have the described relation to each other means whereby a cylinder is driven during a part of its cycle in synchronism with a bed which has a varying movement and during the remainder of its cycle at a constant speed in connection with a clutch mechanism or other suitable similar locking device by which the cylinder is connected to and disengaged from the constant-speed mechanism, the clutch mechanism operating when the cylinder under the influence of one driving mechanism has substantially the speed of the other mechanism.

What is claimed is—

1. In a bed-and-cylinder printing-machine, means whereby the bed is driven at varying speeds, means whereby the cylinder is driven in synchronism with the bed during a part of its stroke, mechanism for driving the cylinder at a constant speed which is substantially equal to the printing speed when it is not driven in synchronism with the bed, and a clutch mechanism for connecting the cylinder to and disconnecting it from the constant-speed mechanism, said clutch mechanism being constructed to be released by the increased speed of the cylinder when it is driven in synchronism with the bed and to be reengaged when the speeds of the bed and the constant-speed mechanism become equal, substantially as described.

2. In a bed-and-cylinder machine, a power-wheel rotating at a constant speed, mechanism whereby the bed is driven from said wheel at varying speeds, means whereby the cylinder is driven in synchronism with the bed during a part of its stroke, mechanism operated from the power-wheel for driving the cylinder at a constant speed which is substantially equal to the printing speed when it is not driven in synchronism with the bed, and a clutch for connecting the cylinder to and disconnecting it from the constant-speed mechanism, said clutch being constructed to be released by the increased speed of the cylinder when it is driven in synchronism with the bed and to be reengaged when the speeds of the bed and the constant-speed mechanism become equal, substantially as described.

3. In a bed-and-cylinder machine, mechanism whereby the bed is driven at varying speeds, means whereby the cylinder is driven by the bed during a part of its stroke, mechanism for driving the cylinder at a constant speed which is substantially equal to the printing speed when it is not driven by the

bed, and a clutch for connecting the cylinder to and disconnecting it from the constant-speed mechanism, said clutch being constructed to be released by the increased speed of the cylinder when it is driven by the bed and to be reengaged when the speeds of the bed and the constant-speed mechanism become equal, substantially as described.

4. In a bed-and-cylinder machine, mechanism whereby the bed is driven at varying speeds, means whereby the cylinder is driven by the bed during a part of its stroke, mechanism for driving the cylinder at a constant speed which is substantially equal to the printing speed when it is not driven by the bed, raising and lowering devices for connecting the cylinder to and disconnecting it from the bed, and a clutch for connecting the cylinder to and disconnecting it from the constant-speed mechanism, said clutch being constructed to be released by the increased movement of the cylinder when it is driven by the bed and to be reengaged when the speeds of the bed and the constant-speed mechanism become equal, substantially as described.

5. In a bed-and-cylinder machine, a power-wheel running at a constant speed, mechanism whereby the bed is driven from said wheel at varying speeds, means whereby the cylinder is driven by the bed during a part of its stroke, mechanism operated from the power-wheel for driving the cylinder at a constant speed which is substantially equal to the printing speed when it is not driven by the bed, and a clutch for connecting the cylinder to and disconnecting it from the constant-speed mechanism, the said clutch being constructed to be released by the increased speed of the cylinder when driven by the bed and to be reengaged when the speeds of the bed and the constant-speed mechanism become equal, substantially as described.

6. In a bed-and-cylinder machine, a power-wheel running at a constant speed, mechanism whereby the bed is driven from said wheel at varying speeds, means whereby the cylinder is driven by the bed during a part of its stroke, mechanism operated from the power-wheel for driving the cylinder at a constant speed which is substantially equal to the printing speed when it is not driven by the bed, a clutch for connecting the cylinder to and disconnecting it from the constant-speed mechanism, the said clutch being constructed to be released by the increased speed of the cylinder when driven by the bed and to be reengaged when the speeds of the bed and the constant-speed mechanism become equal, and raising and lowering devices whereby the cylinder is connected to and disconnected from the bed, substantially as described.

7. In a bed-and-cylinder machine, the combination with mechanism whereby the bed is driven at varying speeds, of a rack on the bed meshing with a gear on the cylinder for driving the cylinder during a part of the



stroke of the bed, gearing rotating at a constant speed for driving the cylinder when it is not driven by the bed, devices for raising and lowering the cylinder to move its gear into and out of mesh with the rack on the bed, and a clutch for connecting the cylinder to and disconnecting it from the constant-speed gearing, said clutch being constructed to be released by the increased speed of the cylinder when its gear is in mesh with the rack on the bed and to be reengaged when the speeds of the bed and the constant-speed mechanism become equal, substantially as described.

8. In a bed-and-cylinder machine, the combination with the bed and mechanism for reciprocating it at varying speeds, of a constant-speed mechanism operating at a speed which is substantially equal to the printing speed, a cylinder adapted to be operated by both mechanisms, and a clutch operating to lock the cylinder to the constant-speed mechanism, the said clutch being constructed to be released by the increased speed of the cylinder under the influence of the bed-reciprocating mechanism and to be reengaged when the speeds of the bed and the constant-speed mechanism become equal, substantially as described.

9. In a bed-and-cylinder printing-machine, the combination with a cylinder, of a disk connected to the cylinder, a constant-speed mechanism, devices acting in conjunction with the disk to connect the cylinder to and disconnect it from said mechanism, and a locking device, substantially as described.

10. In a bed-and-cylinder printing-machine, the combination with the cylinder, of a disk having a plurality of notches connected to the cylinder, a constant-speed mechanism and devices acting in conjunction with the notched disk to connect the cylinder to and disconnect it from said mechanism, substantially as described.

11. In a bed-and-cylinder printing-machine, means for reciprocating the bed at varying speeds, means whereby the cylinder is driven by the bed during a part of its stroke, mechanism for driving the cylinder at a constant speed when it is not driven by the bed, a disk connected to the cylinder, means acting in conjunction with the disk whereby the cylinder is connected to and driven by the constant-speed mechanism when it is not driven by the bed, the transfer from the bed to the constant-speed mechanism being made while the bed is running at a considerable speed and before it reaches the end of its stroke, whereby the cylinder is kept running at a speed which is substantially equal to the printing speed, substantially as described.

12. In a bed-and-cylinder printing-machine, means for reciprocating the bed at varying speeds, means whereby the cylinder is driven by the bed during a part of its stroke, mechanism for driving the cylinder at a constant speed when it is not driven by the bed, a disk

having a plurality of notches connected to the cylinder and means acting in conjunction with the notched disk whereby the cylinder is connected to and driven by the constant-speed mechanism when it is not driven by the bed, substantially as described.

13. In a bed-and-cylinder printing-machine, means for reciprocating the bed at varying speeds, means whereby the cylinder is connected to and driven by the bed during a part of its stroke, devices for raising and lowering the cylinder to connect it to and disconnect it from the bed, a constant-speed mechanism, a disk connected to the cylinder, and means acting in conjunction with the disk whereby the cylinder is connected to and driven by the constant-speed mechanism when it is not driven by the bed, substantially as described.

14. In a bed-and-cylinder printing-machine, means for reciprocating the bed at varying speeds, means whereby the cylinder is connected to and driven by the bed during a part of its stroke, devices for raising and lowering the cylinder to connect it to and disconnect it from the bed, a constant-speed mechanism, a disk having a plurality of notches connected to the cylinder, and means acting in conjunction with the notched disk whereby the cylinder is connected to and driven by the constant-speed mechanism when it is not driven by the bed, substantially as described.

15. In a bed-and-cylinder machine, the combination with a cylinder, of a disk having a plurality of notches fast on the cylinder-shaft, a loosely-mounted gear, means for driving the gear at a constant speed, and means for connecting the gear to and disconnecting it from the disk at specified times, substantially as described.

16. In a bed-and-cylinder machine, the combination with the cylinder, of a disk having a plurality of notches fast on the cylinder-shaft, a loosely-mounted gear, means for driving the gear at a constant speed, means for driving the cylinder at varying speeds, and means for connecting the gear to and disconnecting it from the notched disk, said means being constructed to be released when the speed of the cylinder under the influence of the varying-speed mechanism is greater than the speed of the gear, substantially as described.

17. In a bed-and-cylinder machine, the combination with the cylinder, of a notched disk fast on the cylinder, a loosely-mounted gear, means for driving the gear at a constant speed, means for driving the cylinder at varying speeds, means for connecting the gear to and disconnecting it from the disk when the speed of the cylinder under the influence of the varying-speed mechanism is greater than the speed of the gear, and a locking device for holding the said connecting means in engaging position, substantially as described.

18. The combination with a variable-speed mechanism, of a disk, connections between the variable-speed mechanism and the disk,



a constant-speed mechanism having a rate of speed which is less than the greatest speed of the variable-speed mechanism and greater than the least speed of said mechanism, and an automatic clutch operating to connect the disk to and disconnect it from the constant-speed mechanism at times when its speed coincides with the speed of the variable-speed mechanism, substantially as described.

19. The combination with a variable-speed mechanism, of a disk, connections whereby the disk may be rotated from the variable-speed mechanism, a constant-speed mechanism, a carrier rotated thereby, and means on the carrier for connecting the carrier to and disconnecting it from the disk at substantially the times when the speeds of the variable-speed mechanism and the constant-speed mechanism coincide, substantially as described.

20. The combination with a variable-speed mechanism, of a disk, connections whereby the disk may be rotated from the variable-speed mechanism, a constant-speed mechanism, a carrier rotated thereby, means on the carrier for connecting it to and disconnecting it from the disk at specified times, and a locking device for holding the said means in engagement with the disk, substantially as described.

21. The combination with a variable-speed mechanism, of a disk, connections whereby the disk may be rotated from the variable-speed mechanism, a constant-speed mechanism, a carrier rotated thereby, means on the carrier for automatically connecting it to and disconnecting it from the disk at specified times, and a locking device for holding the said means in engagement with the disk, substantially as described.

22. The combination with a variable-speed mechanism, of a disk rotated thereby, a constant-speed mechanism having a greater speed than the least speed of the variable-speed mechanism, and a less speed than the greatest speed of the variable-speed mechanism, a carrier rotated by said constant-speed mechanism, and means on the carrier for automatically connecting it to the disk made effective by the disk, the said means being automatically disconnected from the disk when the speed of the disk is increased beyond that of the carrier under the influence of the constant-speed mechanism and reengaged when the speeds of the disk and carrier again coincide, substantially as described.

23. The combination with a variable-speed mechanism, of a disk having a plurality of notches, connections whereby the notched disk is rotated by the variable-speed mechanism, a constant-speed mechanism, a carrier rotated thereby, and pawl-arms on the carrier, the said pawl-arms operating to connect the carrier to and disconnect it from the notched disk at specified times, substantially as described.

24. The combination with a variable-speed

mechanism, of a notched disk, connections whereby the notched disk is rotated by the variable-speed mechanism, a constant-speed mechanism, a carrier rotated thereby, pawl-arms on the carrier, the said pawl-arms operating to connect the carrier to and disconnect it from the notched disk at specified times, and a locking device, substantially as described.

25. The combination with a variable-speed mechanism, of a notched disk, connections whereby the disk is rotated from the variable-speed mechanism, a constant-speed mechanism, a carrier rotated thereby, pawl-arms on the carrier cooperating with the notched disk and acting to connect the carrier to and disconnect it from the disk at specified times, and a locking device having high and low cam parts, means for rotating the locking-disk at a different speed to that of the carrier whereby its high and low parts will successively operate to lock the arms to the disk and permit them to be disengaged therefrom, substantially as described.

26. The combination with a notched disk, of means for rotating it at a variable speed, means for connecting the disk to and disconnecting it from said variable-speed mechanism, a constant-speed mechanism, a carrier operated thereby, pawl-arms on the carrier operating to connect the carrier to and disconnect it from the notched disk, a locking-disk, and means for rotating it from the constant-speed mechanism but at a speed different from that of the carrier whereby the pawls are locked to and disengaged from the notched disk, substantially as described.

27. The combination with a notched disk, of a variable-speed mechanism, connections whereby the disk may be rotated therefrom, a constant-speed mechanism, a carrier rotated thereby, pawl-arms on the carrier cooperating with the notched disk whereby the carrier and disk are connected to and disconnected from each other, and a cam mechanism operating to hold the pawl-arms in engagement and permit their disengagement, substantially as described.

28. The combination with the cylinder of a printing-machine, of a disk having a plurality of notches rigidly mounted on the cylinder-shaft, a loosely-mounted pawl-carrier, pawl-arms on the carrier, means for driving the pawl-carrier at a constant speed, means whereby the cylinder may be driven during a part of its cycle at a varying speed, the cylinder being disconnected from the varying-speed mechanism during the remainder of the cycle, and being then driven at a constant speed by the engagement of the disk and pawls, substantially as described.

29. The combination with the cylinder of a printing-machine, of means for driving the cylinder at varying speeds, a notched disk rigidly mounted on the cylinder-shaft, a loosely-mounted pawl-carrier, pawl-arms on the carrier, means for driving the carrier at a constant speed, the pawl-arms being ar-



ranged to engage the notched disk when the cylinder is disengaged from the varying-speed mechanism, and locking devices for holding the pawls in engagement, substantially as described.

30. In a bed-and-cylinder printing-machine, the combination with mechanism for reciprocating the bed at varying speeds, of means whereby the cylinder is driven by the bed during a part of its stroke, of constant-speed mechanism for driving the cylinder when it is not driven by the bed, a notched disk secured to the cylinder-shaft, a loosely-mounted pawl-carrier connected with the constant-speed mechanism, spring-pawls for engaging the notches on the disk, and a locking device for holding the pawls in engagement with the disk, substantially as described.

31. In a bed-and-cylinder printing-machine, the combination with mechanism for reciprocating the bed at varying speeds, means whereby the cylinder is driven by the bed during a part of its stroke, raising and lowering devices for connecting the cylinder to and disconnecting it from the bed, a constant-speed mechanism for driving the cylinder when it is not driven by the bed, a notched disk secured to the cylinder-shaft, a loosely-mounted pawl-carrier connected with the constant-speed mechanism, spring-pawls for engaging the notches on the disks, and a locking device for holding the pawls in engagement with the disk, substantially as described.

32. The combination with a cylinder, of a notched disk secured to the cylinder-shaft, a loosely-mounted gear-wheel adjacent the notched disk, said gear-wheel carrying pawl-arms, means for rotating the pawl-carrying gear at a constant speed, a gear having internal high and low parts also loosely mounted with relation to the notched disk, means for rotating this gear at a constant speed, the speed being different from that at which the pawl-carrying gear is rotated, means for rotating the cylinder at varying speeds during a part of its cycle, the cylinder being rotated during the remainder of the cycle by the engagement of the pawls on the pawl-carrying disk with the notched disk, and a locking-disk acting to hold the pawls in engagement with the notched disk and permit them at the proper times to be disengaged therefrom, substantially as described.

33. In a bed-and-cylinder machine, the combination with a power-wheel running at a constant speed, means for driving the bed from said power-wheel at varying speeds a train of gearing operated from the power-wheel, a pawl-carrier operated from said gearing at a constant speed, a locking-disk also operated from said gearing at a constant speed but at a rate different from that at which the pawl-carrier is operated, a printing-cylinder, means whereby it is driven from the bed during a part of its stroke, a notched disk rigidly mounted on the shaft of the cylinder, the cylinder being driven during the

time when it is not driven by the bed by the engagement of the pawls with the notched disk and the operation of the locking device being such as to hold the pawls in engagement with the notched disk and permit their disengagement therefrom, substantially as described.

34. In a bed-and-cylinder machine, the combination with a power-wheel running at a constant speed, means for driving the bed from said power-wheel at varying speeds a train of gearing operated from the power-wheel, a pawl-carrier operated from said gearing at a constant speed, a locking-disk also operated from said gearing at a constant speed but at a rate different from that at which the pawl-carrier is operated, a printing cylinder, means whereby it is driven from the bed during a part of its stroke, raising and lowering devices for connecting the cylinder to and disconnecting it from the bed, a notched disk rigidly mounted on the shaft of the cylinder, the cylinder being driven during the time when it is not driven by the bed by the engagement of the pawls with the notched disk and the operation of the locking device being such as to hold the pawls in engagement with the notched disk and permit their disengagement therefrom, substantially as described.

35. The combination with a printing-cylinder, of a notched disk rigidly mounted on the shaft thereof, a pawl-carrier loosely mounted with respect to the notched disk, spring pawl-arms pivoted on said carrier, and a loosely-mounted and suitably-driven locking-disk for holding the pawl-arms in engagement with the notched disk and permitting their disengagement therefrom, substantially as described.

36. The combination with a cylinder, of a notched disk rigidly mounted on the shaft thereof, a pawl-carrier loosely mounted with respect to the notched disk, spring-pawls on the carrier, a locking-gear also loosely mounted with respect to the notched disk and having high and low parts coöperating with the pawls, and means for driving the disk, carrier, and locking-gear constantly but at different rates of speed when the disk and carrier are disconnected from each other, substantially as described.

37. In a bed-and-cylinder machine, the combination with the cylinder, of a notched disk loosely mounted on the cylinder-shaft, a pawl-carrier loosely mounted with respect to the notched disk, spring-pawls carried by the carrier, a disk also loosely mounted on the disk and having interior high and low parts, mechanism for operating the pawl-carrying disk at a constant speed, mechanism for operating the locking-disk at a constant speed but at a speed different to that of the pawl-carrying disk, and mechanism for operating the cylinder and notched disk at varying speeds, the parts being so arranged that when the speed of the cylinder and notched disk under the



influence of the varying-speed mechanism coincides with the pawl-carrying disk operated by the constant-speed mechanism, the pawls will drop into the notches of the notched disk, and the locking-disk will be then operated to retain them there, substantially as described.

38. The combination with a bed-and-cylinder machine, of a crank mechanism for driving the bed at varying speeds, a constant-speed gearing, a rack on the bed, a gear on the cylinder, a raising and lowering device for the cylinder whereby it is moved into and out of mesh with the rack of the bed, a notched disk rigidly connected to the cylinder-shaft, a locking-gear meshing with the constant-speed gearing, a pawl-carrying gear loosely mounted with respect to the locking-gear and meshing with the constant-speed gearing, the parts being so arranged that when the cylinder is raised out of mesh with the rack, it will be locked to the constant-speed mechanism by means of the notched disk, pawl-carrying disk and locking-gear, and when it is lowered into mesh with the bed, it will be released from the constant-speed mechanism, through the increased speed given it by the bed, substantially as described.

39. In a bed-and-cylinder machine, a mechanism for driving the bed at a varying speed, a constant-speed mechanism, a cylinder adapted to be operated by both mechanisms, a device for positively locking the cylinder to the constant-speed mechanism, the locking device being so constructed that it will be automatically released when the cylinder is connected to both mechanisms and its speed is increased under the influence of the varying-speed mechanism beyond that of the constant-speed mechanism, substantially as described.

40. In a bed-and-cylinder machine, the combination with a gear rotating at a constant speed, a crank mechanism operated by the gear and reciprocating the bed at a varying speed, a rack-and-gear connection between the bed and the cylinder whereby the cylinder is operated by the bed during a portion of its stroke, a train of gearing in mesh with the gear rotating at a constant speed, a locking mechanism for positively locking the cylinder to and releasing it from the gearing, the locking mechanism being constructed so as to positively lock the cylinder to the gearing when the cylinder and the bed are rotating at the same speed and thereafter slip so as to release the cylinder from the constant-speed mechanism when under the influence of the bed its speed increases beyond that of the constant-speed mechanism, substantially as described.

41. In a bed-and-cylinder machine, the combination with a bed reciprocating at varying speeds, a cylinder driven by the bed during a part of its stroke, a constant-speed mechanism

for driving the cylinder when it is not driven by the bed, auxiliary intermediate devices operating at substantially the times when the speeds of the bed and the constant-speed mechanism coincide to connect the cylinder to and disconnect it from the constant-speed mechanism, and means between the bed and the cylinder operating to correct any irregularity in the motion of the parts and properly position the bed and cylinder when the two come into driving relation, substantially as described.

42. In a bed-and-cylinder machine, the combination with a bed reciprocating at varying speeds, a cylinder driven by the bed during a part of its stroke, a constant-speed mechanism for driving the cylinder when it is not driven by the bed, auxiliary intermediate devices acting at substantially the times when the speeds of the bed and constant-speed mechanism coincide, to connect the cylinder to and disconnect it from the constant-speed mechanism, and a bowl and cam carried by the bed and cylinder and operating to correct any irregularity in the motion of the parts and properly position the bed and cylinder when the two come into driving relation, substantially as described.

43. In a bed-and-cylinder machine, the combination with a bed reciprocating at varying speeds, a cylinder driven by the bed during a part of its stroke, raising and lowering devices for bringing the cylinder into and removing it from its driving relation with the bed, a constant-speed mechanism for driving the cylinder when it is not driven by the bed, auxiliary intermediate devices acting at substantially the times when the speeds of the bed and constant-speed mechanism coincide, to connect the cylinder to and disconnect it from the constant-speed mechanism, and a bowl and cam carried by the bed and cylinder and operating to correct any irregularity in the motion of the parts and properly position the bed and cylinder when the two come into driving relation, substantially as described.

44. The combination with the cylinder and reciprocating bed having an intermeshing rack and segment, of means for raising and lowering said cylinder, and means for causing the lowering devices to impart a partial downward movement when the cylinder is tripped, substantially as described.

45. The combination with the cylinder and reciprocating bed having an intermeshing rack and segment, of means for raising and lowering said cylinder, and tripping mechanism for said cylinder embracing a dog having two acting shoulders producing different positions of the cylinder, substantially as described.

46. The combination with the bed and cylinder having intermeshing devices, of means for raising and lowering the cylinder and means causing the lowering devices to lower



the cylinder into position insuring engagement of the intermeshing devices but without causing other contact during the time the cylinder is tripped and moving with the bed, substantially as described.

47. In a bed-and-cylinder machine, the combination with the cylinder, of means for raising and lowering the cylinder and operating devices for said means, connections between the operating devices and the raising and lowering means, said connections being constructed so that the downward movement of the cylinder may be varied, and controlling devices for said connections which permit them to be operated only at predetermined intervals, substantially as described.

48. In a bed-and-cylinder machine, the combination with the cylinder, of means for raising and lowering the cylinder, a cam, a rocking lever operated by the cam, pins at varying distances from the center of motion of the rocking lever, and means for connecting either of the pins to the raising and lowering devices, substantially as described.

49. In a bed-and-cylinder machine, the combination with a cylinder, of means including a toggle for raising and lowering the cylinder, a gab-hook connecting with the toggle having recesses on its opposite side, a pivoted lever carrying upper and lower pins, mechanism for rocking the lever, and devices for positioning the gab-hook so that it will operate in connection with either the upper or the lower stud, substantially as described.

50. In a bed-and-cylinder machine, the combination with mechanism for raising and lowering the cylinder, the same including a toggle, a gab-hook connected with the toggle, a locking-lever carried by the upper and lower pins, devices for positioning the gab-hook so that it will engage with either pin, means for rocking the lever, and means for preventing the operation of the gab-hook-shifting device

except at specified times, substantially as described.

51. In a bed-and-cylinder machine, the combination with a toggle and connections whereby it may raise and lower the cylinder, of a gab-hook extending from the toggle, a rocking lever bearing upper and lower pins, devices for positioning the gab-hook so as to engage the lever-pins, a cam for operating the rocking lever, a cam projection carried on the gab-hook, and a cam constructed to engage either side of the cam projection according to the position of the gab-hook whereby to prevent the gab-hook from being operated except at specific times, substantially as described.

52. In a bed-and-cylinder machine, the combination with a cylinder having a gear, of a bed carrying a rack, devices for raising and lowering the cylinder, and means whereby the said devices may be controlled in the lowering operation so as to bring the cylinder down sufficiently to engage it with the rack on the bed and yet permit it to be off the impression, substantially as described.

53. In a bed-and-cylinder machine, the combination with a cylinder carrying a gear and a bed carrying a rack, of devices for raising and lowering the cylinder, the same including a rocking lever, means for giving a constant throw to the lever, connections whereby the constant throw of the lever is caused to lower the cylinder different distances, and controlling devices for said connections which permit them to be operated only at predetermined intervals substantially as described.

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

LUTHER C. CROWELL.

Witnesses:

JAMES Q. RICE,  
T. F. KEHOE.